HEALTH THROUGH RATIONAL DIET

BY

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HEALTH AND LONGEVITY

THROUGH

RATIONAL DIET

PRACTICAL HINTS IN REGARD TO FOOD AND THE
USEFULNESS OR HARMFUL EFFECTS OF THE
VARIOUS ARTICLES OF DIET.

BY

DR. ARNOLD LORAND
CARLSBAD

"Tell me what thy food is, and I will tell thee what thou art."
BRILLAT-SAVARIN

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PREFACE.

PROBABLY but very few physicians have so frequently an opportunity to observe the harmful consequences of a faulty mode of nourishment as one who is practising as a Carlsbad bath physician. It is a surprising fact that even scholars well versed in a great variety of subjects often display the veriest ignorance or show the greatest carelessness precisely in respect to what and the manner in which they eat.

Others, again, fall into the opposite error,—those, for example, who studiously avoid all foods containing even a trace of uric-acid-forming constituents, lest an excess of such substances prove injurious, and meanwhile overlook the fact that in addition to such uric-acid-producing components these foods contain many other important substances, *e.g.,* certain nutritive salts, an insufficient intake of which may result in serious injury, particularly in the period of growth and development of the body.

Because overeating may prove harmful, many persons restrict their diet to such an extent as to do their bodies more harm than they would by eating to excess. Every housewife knows that her dog or cat will thrive splendidly when plentifully fed upon proper food, but in the case of her children she often overlooks this point. Every farmer, too, is aware of the fact that horses require altogether different kinds of food, according as they are to be used as draught, riding, or carriage horses, and that a dog, to be used in the hunt, as a watch-dog, or to draw carts needs a different diet in each case. It is only in man that we observe the contrary condition, viz., that persons following most diverse occupations, be they laborers or brain-workers, scholars, merchants, officials, officers, clergymen, physicians, traveling salesmen, factory hands, or field workers, —all of them with their dependents, take the same or at least very similar foods.

The diet should vary according to the nature of the occupation and the functions to be carried out, just as has always been the custom in the case of domestic animals. Since certain nutritive salts play an important rôle in the activity of various organs, as, *e.g.*, those containing phosphorus in brain activity, as full a consideration as possible has been given in the present volume to the question of the nutritive salt content of all varieties of food. In presenting the quantitative relations of these salts as well as the percentages of the various classes of foodstuffs contained in the articles of diet considered, I have made use of the figures given by König, Rubner, Bunge, E. Wolff, Robert Hutchison, Gautier, and Balland.

Since through unintelligent and, one might almost say, brutal methods of cooking many important nutritive substances and salts are withdrawn from our foods, I have found it necessary to include a discussion of rational methods of cooking as well as of several other questions which lie somewhat outside of the sphere of the practising physician.

Many of the subjects here discussed have previously been but little or hardly at all touched upon in scientific works, as, *e.g.*, the manner in which various functions such as the intelligence, the sexual function, etc., can be activated through the diet.

The author is not so presumptuous as to affirm that he has already definitely solved the question as to how it is possible to convert a stupid school child into a bright one, or to restore a person sexually weakened through congenital deficiency or as a result of various vices to normal sexual vigor, with the aid of an appropriately selected diet and certain kinds of food. If, however, he has succeeded in making some slight contribution to the subject or even only in stimulating further research along these lines, as well as in eradicating certain faulty and life-shortening practices in regard to eating, the purpose of this work will have been fulfilled.

DR. ARNOLD LORAND.

INTRODUCTION.

BY

VICTOR C. VAUGHAN.

WHEN Dr. Lorand asked me to write a foreword to the American edition of his well-known and highly esteemed treatise on "Rational Diet" I gladly consented. The author has had large practical experience in the dietetic treatment of many disorders at the greatest and oldest of the world's health resorts, Carlsbad. This resort, annually visited by thousands who come from all parts of the world, is free from medical quackery, and the simple life enjoyed there is not the least helpful of its beneficial agencies. Moreover, Dr. Lorand has been an extensive and observant traveler, especially interested in the foods used and the methods of preparation employed by different peoples. I am fairly conversant with the German edition of this popular work on dietetics, and I have read the proof of the English translation. While I might take issue with the author on certain unimportant points, it is my conviction that the work has been admirably done, and is certainly free from the fads which render so many of the books written on this subject, for the laity, harmful. The highest scientific authorities have been consulted, and their researches made comprehensible to the non-professional. The body is a machine, the most complicated and neatly adjusted one in existence. Foods supply not only the fuel used in running this machine, but also the material with which the wear and tear must be replacd. Every engineer knows that he cannot get the greatest efficiency out of his machine unless he supplies the fire-box with the best, high-grade fuel. With dirty, low-grade coal the result is not up to the standard, and when it contains a large amount of sul-

phur and other impurities the life of the machine is impaired. Pure air to breathe, wholesome water to drink, and proper food to eat should be secured by the State for all its citizens, the poorest as well as the richest. The man who traffics in impure, diseased, and adulterated food is a malefactor, and should be treated as such. We may have good laws upon these subjects, but they will not be adequately enforced until the public becomes properly educated along these lines. The purpose of this book is to contribute to this much-needed education. A government which permits the sale of injurious foods, or allows the price of proper foods to be manipulated by any man or combination of men for financial gain, is not serving its citizens in a just, wise, or humane manner.

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INTRODUCTION, WITH REMARKS UPON THE IMPORTANCE OF THE APPETITE AND THE OBJECT OF THE PROCESSES OF NOURISHMENT.

Two instincts, that of hunger and the sexual impulse, hold man enthralled in an iron grip, and afford, consciously or unconsciously, the motive power for many bad, as well as for many useful, acts. Both man and beast owe their existence and their perpetuation to these impulses.

These two instincts worry and torment all living beings, and in order that their calls may be more readily obeyed they hold out the lure of enjoyment. A dog may be ever so hungry, yet often refuse a food which may be most nourishing, if it does not appeal to his taste, and rats often die of hunger in captivity, rather than eat food which they do not like. Man, with his intelligence, is an exception, and will often eat distasteful food when starving; no matter how nourishing such food may be, however, he will only take that which is barely sufficient to still the pangs of hunger. In order that man or animals shall take a sufficient quantity of useful food to satisfy bodily requirements, omniscient Nature has at the same time provided him with the sense of taste, which acts as a bait for enjoyment. Thus, albumin, a most important foodstuff, would, in the form of white of egg, be refused by many dogs, even though suffering with hunger; when, however, the albumin has combined with it a savory flavor, as in the form of the extractives in meat, the dog will eagerly devour it. The

second important constituent of the food, the carbohydrates, would not be very tempting in the original tasteless form of starch, but when it is combined with a series of tasteful substances, as, *e.g.*, in the potato, it forms a favorite and universal food staple. Fat, likewise, does not taste nearly as good in the form of pure oil as it does in butter in which aroma and savor pave the way to its enjoyment.

The child, with its undeveloped intelligence, prefers those foods which appeal most strongly to the sense of taste, *e.g.*, the sugar in candy. That milk which is most rich in sugar, like mother's milk, is most desired by the nursling. In milk are contained all three of the chief components of food, and the sugar contained in it makes it pleasant to take. A milk entirely free from sugar would scarcely be accepted by the child.

Besides the albumin, fat, and carbohydrates, the nutritive salts also play an important rôle as essential nutritive substances, and the delightful fragrance and taste of the fruits which contain them in large quantities make such fruits very tempting.

In this way necessary substances, which exert a great influence upon the composition and constitution of the blood and our most important tissues, are taken into the body.

Taste-exciting substances are, to be sure, rather perishable, and are only present in their entirety while the plants remain in relation to the earth through the agency of their roots. When grass is mown and allowed to dry upon the meadow, its perishable taste-arousing components, which excite the cow to constant eating, are lost. This is particularly the case if the grass has not been piled up in mounds, to prevent the carrying off of these components by the wind. The quality of the butter subsequently obtained is also affected under such conditions. I have often noticed the fact that a bilberry or raspberry tastes best when plucked from the bush. After having been picked for some time, much of the aroma is lost.

The most tasty fruit and vegetable foods can, therefore, only be thoroughly enjoyed by those living in the country; we, in the cities, get only a fraction of this enjoyment, for such foods rarely come to us quite fresh. How true the saying of Horace: "O fortunalos illos agricolas!"—O happy country people! The tilling of the soil by farmers provides us with plentiful and healthy foods when all the appliances which modern science has given us are brought into use. It is surely an anomaly when the land is so neglected as is the case with thousands of hectares in Austria and Hungary, and in Germany, which remain uncultivated. With good will and industry, these fallow lands could, with the aid of modern agricultural knowledge, be made to furnish us an ample supply of bread, fruit, and vegetables. Much is accomplished in farming in the United States, where the government sends entire schools to outlying districts in cars especially constructed for the purpose, and equipped with the necessary agricultural apparatus, in order to teach the farmers how to obtain a tenfold return from their fields, cattle, and poultry. How desirable it would be for us to have such a useful arrangement, in order to further the rational nourishment of our people! The yearly emigration from Austria and Hungary of hundreds of thousands of our most useful population, the farmers or husbandmen, to America or Canada, where virgin lands, promising a rich harvest, are given to them free of cost, could thus be avoided. Of those who remain at home, thousands forsake their former healthy vocation, and, instead of being happy in the possibility of breathing the delightful, health-giving open air of nature itself, they sacrifice their health in the large cities, in the smoky impure air of the factories, and eat food which, at home, would have been despised by their dogs.

It is true that those who have abandoned their mother country find in Canada a fresh, virgin soil, which soon furnishes plentiful nourishment, while, with us, the earth, in the

hundreds of years during which it has been cultivated, has already yielded almost all of its nutritive salts.

But the illustrious Justus von Liebig taught us how to overcome this difficulty: we must artificially provide the plants with these salts; and since we ingest these plants as our food, sometimes through the circuitous route of the meat of animals who have themselves been nourished by them, these nutritive salts will be taken into our bodies and exert an active influence in their building up and health. As a matter of fact, nearly all the substances contained in our bodies are brought in from the outside, and this mainly through the food we take. The components of the earth are also absorbed in the form of salts, which are concerned principally with the formation of our bony structure. Another element, besides the earth, plays an important rôle in the nutrition both of plants and of ourselves. However much of nutritive salts be at the disposal of plants, these salts are of no use until the rain comes and takes them in solution; in the same way we are enabled to absorb our food only by the aid of water.

Still another body, the air, is of great importance in the building up of our food. Plants absorb the all-important carbon from the air, and many of them—as the leguminous plants—also take up nitrogen through their roots with the aid of the nitrogen-gathering bacteria. When we eat these plants, or the meat of animals which have fed upon them, the nitrogen is taken up into our systems.

In addition to the elements mentioned, a powerful heavenly body comes to our help in the formation of our nourishment, one without which no man, animal, or plant could exist,—the sun.

By the aid of the sun's rays, the carbonic acid of the air, through the agency of the chlorophyll, furnishes the starch required for the healthy growth of plants. The longer the sun shines upon the plants, the more starch is formed in them.

For this reason, the plants—trees and fruits—growing in the bright sunshine of the south contain more starch, to which millions of savages owe their principal food. Thus, we see that nothing is lost in this world, and that the sun's rays have not shone in vain upon these plants, since we can absorb the energy stored up in them through the agency of the sun's rays, by eating their starch-containing fruits, such as bananas, figs, rice, etc. Even those rays of the sun which streamed down millions of years ago upon the plants of former ages, including the stately conifers of those times, are not lost to us. They are useful since we now burn upon our hearths the products of those distant ages, transformed into coal. With their heat the warmth, and with their burning the light, of the sun reappear, even as they do when we hold a match to the petroleum in our lamps—also a distillation product of former ages. We thus, in a sense, not only consume the sunlight, but also cook our meals thereby. Even the lifeless mineral world lends us its aid for our nourishment. Thus, the phosphates, found in large quantities in South Carolina, Florida, Algeria, etc., are used by us to fertilize our fields, in order to furnish the necessary phosphorus to the grain; and from the grain, we absorb this phosphorus in our food. The manufacturing industries likewise, though otherwise the foes of land cultivation, are helpful to us, as the phosphorus used in fertilizing is also obtainable from the waste material of iron factories, in the form of ground Thomas phosphates. Nitrogen, too, can be elaborated from the sulphate of ammonium contained in the residue of the gas and coal industries, or gathered from the air by the aid of electricity.

All the elements thus enter into our nourishment, and, since we are built up by what we absorb, we are also composed of these elements. After our death, when our bodies are decomposed, these substances are set free again. It is literally true, as the Holy Scriptures state, that man is made of dust

and to dust returns. New organisms are built up with the elements again rendered free by the decomposition of our bodies, and it would appear as though our decay and natural death were a grim necessity, in order that from our worn-out and decomposed component parts new combinations with fresh energy, new beings, in fact, should arise.

From the organic portions, the salts, and other substances which have been liberated from our moldering bodies and taken up by the water in the earth and springs, new plant bodies, *e.g.*, grass, spring up. As the grass is eaten by the cattle, flesh is again formed from it, which can be utilized by us, or is once more excreted, in the dung, forming an efficient fertilizer, through the influence of which the most juicy fruits, the finest strawberries and vegetables, grow, again to be absorbed by us. Thus, in life a continuous cycle is established of which the process of nourishment is the activating influence. Old forms of life disappear—for plants have life, as do man and the animals—and new ones are engendered. The above observations, however, also show us that cremation of dead bodies does not fit in with this, our predestined use; it removes our bodies from their ethical duty, the elaboration of new living beings. Since the thought of the burial in a closed grave is really painful to many persons, it would be of use and would further this ethical end if the ashes, instead of being uselessly sealed up, were scattered broadcast over the fields in the springtime, where they would lie in the light of the sun until the rain could carry their helpful influence into the soil. What a beautiful destination this would be for many who during their lifetime were able to accomplish but little, thus to serve mankind —possibly in this way accomplishing their most useful act! The church, too, could find no objection to this, since the dust would again return to the dust from which it had arisen.

Since so many valuable substances, among them most useful mineral constituents, unite in providing for our nourish-

ment and are embodied in us, it must surely follow that they are accomplishing a higher mission than the mere tickling of our palates. He who believes that we eat for the sole purpose of satisfying our hunger and of satiating or indulging ourselves when our food tastes good only proves his own simplicity, and gives us reason to believe in the truth of the words of Socrates: "The bad live to eat and drink, but the good eat and drink to live." No; we must energetically proclaim our belief, that eating is a higher function,—a kind of religious act. We eat in order to build up our tissues, we eat in order to put ourselves into condition to withstand the endless assaults of lower organisms which attack us by day and by night, and we also eat in order that our organs, and in particular our brain, will be enabled rightly to perform their functions! We are only able, however, to carry out these functions when we have absorbed certain salts, the nutritive salts, with our food and drink, among them being phosphorus and lime, without which life is impossible. In addition to the nutritive salts many important medicinal substances, such as iron, iodine, and even salicylic acid, are ingested with certain fruit berries. Though the amounts absorbed are minimal, homeopathic doses, yet they are of no inconsiderable importance in the chemical laboratory represented by our bodies. In this sense it might be said that we are taking in along with our food medicinal or curative agents no doubt even more efficacious than those compounded by the druggists. It follows, therefore, that he who nourishes himself with wisely chosen food can maintain his body in such a state of health that he will not need any form of artificial medicine. Not only does health of body and mind depend upon the food, but it is also built up from childhood, and appears to be responsible for the making of man what he is,—the most advanced creation of the animal world. While man has attained this station by virtue of his intelligence, we shall show later on that this intelligence, too, depends

upon his food. As a matter of fact, we find that wherever man is restricted to a sparse, one-sided, and incomplete diet,—and that of most animals is of this nature,—as are the inhabitants of many of the southern islands, and the Bushmen, his intelligence is likewise of the lowest order. Thus, the ancient Aztecs, who already cultivated corn and cocoa, and lived on a plentiful and varied diet, although principally a vegetable one, had a well-ordered state, with courts of justice very similar to our own. We can also show, by means of instructive examples of which we shall give several later on, how both man and beast are made what they are by their foods. I would like, however, to cite here one example from the life history of the bees, quoted from Roberts. As soon as the bees need a new queen, they feed the larva of a worker with the finest portions of the jelly-like substance contained in the hives, called "royal jelly" by the English bee cultivators. While the rest of the larvæ, which are to form the workers, only get this dainty substance on the first day, the one selected to be the queen is constantly fed with it until fully grown. As the result, a bee is developed which is several times as large as the others, and is also more intelligent. Many examples can, moreover, be mentioned of the manner in which the various tissues of mankind and of animals are influenced by this mode of nourishment. This will be described in the following chapters, and I shall only adduce here the instructive example of an experiment performed by John Hunter: Birds living upon vegetable food, *i.e.*, those eating grain, possess a hard, horny musculature in their stomachs,—for otherwise they would not be able to digest such hard food. The carnivorous birds, gulls, for example, do not require this muscular structure. Hunter, the great physiologist and surgeon, fed gulls upon grain only. The consequence was that the stomachs of these birds grew to be like those of the naturally graminivorous birds. From the above it follows that man and beast are made what they

are by their food, and, therefore, that we are able, by a deliberate choice of our food, to influence our minds and bodies in the most favorable manner for the accomplishment of our best achievements. *To bring about this result is the main object of our use of food.*

CHAPTER I.

THE INFLUENCE OF FOOD UPON MAN.

1. *The Influence of Food upon the Outward Appearance of Man, His Stature and His Development.*

Food exerts so great an influence upon man that even the size of his body may be essentially affected thereby. Thus, we see that nations which nourish themselves with articles of diet rich in nitrogenous elements, that is, with plenty of meat, in addition to a sufficient quantity of the other main groups of foodstuffs, *e.g.*, the English, the Swedes, and other nations living in a similar way, attain to a considerable physical development.

One might, perhaps, attribute this circumstance to the influence of the cold and damp climatic conditions, but even in Africa there is a tribe, the Watussi, which is richly nourished, since its members possess extensive herds of animals, with plenty of pasture land, and these people, according to the description given of them by Duke Adolf Frederick of Mecklenburg, are also noted for their great physical development. Among them there may be seen many individuals of a height of 2 meters, and even more. When, however, an exclusive nitrogenous meat diet is indulged in, as with the Eskimos, growth is hindered, and low stature is the rule. Not in this case either can the climate be considered a factor, for in that of tropical Africa there may be found, in addition to the above-mentioned giants, tribes of dwarfs, the Batwa and the Wambuti. These forest-living dwarfs are like the Eskimos in that

they also feed almost exclusively upon meat. There can be no question of coincidence in the matter. There must therefore be a certain relationship between modes of nutrition and growth. This relationship must be of such a nature that, in the pronounced growth of those persons living upon a diet rich in meat, a certain influence is brought to bear upon the organs which regulate bodily growth. These organs are the thyroid gland, the sexual glands, and the hypophysis. They influence, in particular, the metabolism of lime and phosphorus, which are the main elements of which the bony structure is composed. When these organs have degenerated, growth does not usually take place, and when there is defective development of the sexual glands the well-known dwarf-like condition of the cretins often occurs. The experiments of Briesacher, Blum, and others have proven that a meat diet—and this preferably not in the form of meat which has been boiled out—has a stimulating influence upon the thyroid gland. The increased growth of the nations named above can be accounted for in this way,—also the fact often observed among our own people, viz., that the children of the wealthy who often eat roast meats and other articles of food rich in nitrogenous substances frequently grow very tall, while, on the other hand, the children of poor people often develop very slowly. This would likewise afford an explanation of the large number of tall persons in the aristocracy, and among the well-to-do classes where riches have existed during generations, as in the patrician families.

In animals, as, for instance, in the horse, the same facts may be observed: the English race horses, well fed with oats, present a marked contrast to the puny Hungarian farm horses, fed principally with hay.

The children of stunted growth seen in the poorer classes can often be made to grow more rapidly by generous feeding and perhaps even artificially, so to speak, by the administration

of extracts of the thyroid and sexual glands of animals. Hertoghe has shown that a surprising development occurs in backward children after treatment with thyroid extracts. This is plainly to be seen in the illustrations he published. I have frequently obtained the same results by the administration of thyroid extract. Thus, last summer, after six weeks' combined treatment with thyroid and testicular extract in the case of a 14-year-old lad, with undeveloped sexual glands, a very marked increase in growth was observed, about 1 cm. each week. There occurs also a remarkable development of the mentality in such children. Practically the same results may be brought about by a carefully selected diet during the period of development in children. I may here also cite a surprising example of this in the plant world. If a plant is given plenty of nitrogen in manure, it will grow to twice the height, or even more, that a similar plant without manure will, especially if phosphorus is added to the fertilizing agent.

When nourishment is poor and insufficient, man cannot develop properly; thus, Burton found the inhabitants of Dahomey very small and shriveled in appearance. Their food is miserable; in order to get meat, they are obliged to fatten dogs and eat them.

When, on the other hand, the food consists almost exclusively of meat, as with the Eskimos and the dwarf tribes of the virgin forests, here, again, man cannot grow properly. There must here be some injurious action, due to the excessive meat diet, upon the ductless glands which regulate the growth of the body, viz., the thyroid and sexual glands. That this actually does occur has been shown by the experiments of Chalmers Watson and of Hunter. Chalmers Watson found that the thyroid gland of rats and of chickens fed only upon meat became degenerated. More recently Chalmers Watson and Hunter have shown the following: Of 14 rats fed on meat alone, only 8 remained alive. During the eight months

of the experiment, it became evident that the development of these animals was entirely arrested, and that they did not grow at all. Houssaye kept hens upon a meat diet, and they laid no eggs. It can, moreover, be observed that hens stop laying and grow coarse, wild feathers when farmers are careless enough to give them meat or blood as food. This clearly demonstrates the influence of food upon the outward appearance of animals. An instructive example of this fact, related by Roberts, may here be cited: In the Amazon region there is a variety of green parrot. When the natives feed these birds with the fat of large fishes of the siluroid class, found in the Amazon, which food the birds greatly enjoy, these parrots grow a coat of beautiful red and yellow feathers. In the Malay Archipelago a kind of parrot is found which is called Lori Rajah—"King Lori." With the usual rice food these birds are unattractive in color, but if they are fed upon fish their feathers take on a brilliant hue.

In order that man shall thrive on his food, it must be varied, and, above all, it must contain sufficient nitrogen, *i.e.*, albumin—though not too much, or it may prove injurious. When, however, the diet contains too little thereof, it is much more harmful. We see this in the Hindoos, who live mainly upon rice and millet. They, as well as the majority of Japanese people, who also feed almost exclusively upon rice, and likewise the Chinese and the Malays, are all thin; and since the nitrogen is not sufficiently represented in their nourishment, they very rarely grow tall, with the possible exception of the Manchus, who resort to a rather richer nitrogenous diet. Chalmers Watson and Andrew Hunter also showed, in their experiments already referred to, that young rats fed only upon rice were backward in growth.

The vegetarian negro tribes also remain lean. Stout people are almost never seen among them, while, on the contrary, the negroes living upon a mixed diet in the United

States often show a considerable abdominal development. In my country, too, there is no lack of persons with overdeveloped abdomens, and the majority of those people who, together with a sufficient meat diet, eat plenty of pastry and sweets, and likewise drink much beer, may of a certainty count upon such an alteration in their appearance. In this connection the ductless glands, those wonderful structures the influence of which upon the entire organism I have more fully described in my work "Old Age Deferred," play an important rôle, inasmuch as they regulate the metabolic processes of the organism.

Upon the outer covering of the body—the skin—the food also has an influence. This, in many persons, shows itself in the occurrence of rashes and eruptions after the ingestion of certain foods, as cheese, strawberries, etc. When the flesh of animals which subsist in an unclean medium, as do occasionally the oysters, or which eat refuse and decomposing substances, as do lobsters and crabs, is eaten, such an eruption is frequently observed to appear. Comparable with this is the occurrence of eczema after fish that is not fresh has been partaken of. Very interesting is the appearance of widespread eruptions such as those which occur in Java when one has eaten a kind of mango fruit, the mangoguani. In Brazil it is a well-known fact that persons, and especially those who have once had syphilis, may count with certainty upon having a widely diffused eruption of the skin after having eaten of the meat of the tapir. This animal feeds upon all manner of refuse, and very often there may be found in its stomach pieces of wood, lumps of earth, etc. It is very probable that the above symptoms, appearing after one has eaten fruit grown in an unclean soil or the meat of animals which ingest injurious substances as food, are to be regarded as the result of the poison-eliminating function of the skin.

2. *The Influence of Food upon the Nervous System and upon the Attributes of the Mind and Temperament.*

Many wild animals become remarkably tame when deprived of a meat diet. Justus von Liebig noticed in Giessen a young bear that was very tame when no meat was given him, but became wild and unmanageable when again fed upon meat. Tamers of animals, moreover, make use of this fact, simply by bringing up young animals, whenever possible, entirely without flesh food, the animals being thus rendered quite tame, so that they are easily trained.

To a greater or less degree the same may be observed in man. It is a fact that nations that live upon a vegetable diet, and in particular mainly upon rice, as do the majority of the Chinese, the Hindoos, etc., are of a peace-loving nature. As an illustration of the converse I would like to cite the interesting example given by Captain Merker of an African tribe, the Masais, a branch of the Semites. As related, in his great work on these interesting people, by Captain Merker, whose premature removal from his scientific labors by death is greatly to be deplored, all the warriors of this brave and warlike tribe live exclusively upon meat, blood, and milk, in companies apart from the rest of the people. The Spartans ate bloody soups and rare meats as a daily food. Liebig[1] states that carnivorous animals are more courageous and savage than the herbivorous ones, which actually become their prey.

The nations living principally upon vegetables are less prone to engage in warlike enterprises; they like quiet and peace, and are especially lacking in initiative and energy. This need not surprise us, for it is precisely the albumin, of all food substances the greatest promoter of energy, which is very sparingly represented in their aliments. It is owing to this

[1] Justus von Liebig: Lancet, 1869, p. 186, cited according to Pavy.

fact that a comparatively small number of meat-eating, energetic Britishers and Dutchmen have mastered millions of rice-eating Hindoos and Malays, and that a few Belgians were able to subjugate the millions of inhabitants of the enormous Congo regions, who, with the exception of the forest-dwellers, live upon the starchy flour made from the manioc and other similar roots, and upon millet, batates, and bananas—all of them poor in albumin, save the millet, the albumin in which is, however, rather difficult to make use of. It would be incorrect, of course, to ascribe all this solely to the influence of the inferior food—the higher intelligence and achievements of civilization also play their parts. Nevertheless, the kind of food partaken of since childhood makes man, to a great extent, what he is in physique. We shall show, too, that intelligence and all mental attributes in general are greatly influenced by food.

While the nations living principally upon rice and other foods equally poor in nitrogen are lacking in energy and initiative, they possess another characteristic in which they surpass other nations, viz., their untiring capacity for work. When a meat-eater has a heavy load to carry, he soon becomes overheated, perspires, and very soon grows tired. It is quite otherwise with the carbohydrate-eating vegetarian, who does not suffer in the same way,—a fact which I have myself tested by experimenting with various kinds of food. The ability to work is maintained through combustion of the carbohydrates, and the vegetarians are able, as we shall later explain more fully, to continue certain kinds of work, such as marching, rowing, etc., much longer than meat-eaters, without being so fatigued, even after a very long period of activity. We shall also relate almost incredible feats performed by the Congo negroes and other vegetarian tribes. One example may, however, here be mentioned: As the troops of Tippo Tipp were being annihilated, a Congo negro carried the joyful news in a letter from Lukungu to Matadi in one day, a distance of 100

kilometers, and another negro carried the letter on from Matadi to Leopoldsville, another stretch of 100 kilometers, also in one day. When we consider that this was over untrodden roads, not in any way to be compared with ours, and, furthermore, remember the tropical temperature, which, while it does not particularly affect the Congo natives, must nevertheless be taken into account, the feats just mentioned must be regarded as most remarkable.

Another advantage of a diet largely vegetarian lies in the fact that nervousness is, in general, less prevalent among people living upon such food than in those who are meat-eaters. In this respect there exists a certain inferiority in the meat-eating European, as compared with the Orientals and other vegetarian nations, who look down upon the Europeans on this account, and have but little consideration for them.

Foods may influence the nervous system through the intermediary of the blood supplied to it. Deterioration of food or the presence of injurious substances therein may generate certain toxic products in the blood, thus giving rise to an inflammatory condition, a toxic neuritis. Certain substances contained in meat stimulate the nervous system, the extractives, for instance. Taken in large quantities, these may exert an irritating effect, either directly or by affecting the thyroid gland, which has a powerful influence upon the nervous system.

The quantity of food also plays an important rôle, as insufficiency thereof, more especially of the albumin contained therein, very greatly affects the quantity and the composition of the blood, and consequently also affects the condition of the nervous system, which is nourished by the blood. The centers of thought can only carry on their functions when well supplied with blood. When, through a diseased condition of the smaller blood-vessels and stenosis of them because of arteriosclerosis or syphilis, the centers are poorly supplied with blood, very marked disturbances of the intellect may occur. This

may also take place, though in a less degree, when the blood is impoverished and also diminished in quantity owing to an insufficiency of albumin in the food. Very frequently the intellectual attainments of undernourished persons are quite different from those of the well-fed. Persons suffering from hunger may sometimes, it is true, achieve very praiseworthy results in intellectual pursuits, but necessity is here the motive power, and these same persons would most probably accomplish very much more under a generous diet. Many a neglected genius would soon make itself felt if, in the stress of need, a helping hand could be held out to it; instead, it is unfortunately left to struggle on in misery. Especially in the case of gifted children, who, like all children, require ample nourishment during the period of growth, the State should lend assistance wher the parents are needy. Such children should be well nourished and taken care of. There are plenty of industrious pupils, but those with original and ingenious ideas are very rare, and these should, in the interest of the development of mankind, not be left to starve.

That the nourishment exerts a great influence upon the quality of the intellectual accomplishments cannot be denied if we consider the difference between the products of the mind evolved under different forms of diet. It is certain that the meat-eating or, we may rather say, albumin-consuming, people have accomplished much more in the way of original and creative work than those leading a vegetarian life. The English and Americans, who are great meat-consumers, rank among the first in the field of initiative knowledge and invention. In order to illustrate the influence of food upon the intellectual activity, I should like to place side by side for comparison a young American boy of 14 years who eats meat even at breakfast and a pale, bespectacled German lad of 14. Although the American might know less of dead languages and of abstract science which he would never have any use for

during his life, he would certainly surpass the other in intelligence and common sense.

Were we to ascribe the superiority of the meat-eaters, or, more precisely speaking, of those who absorb a great deal or at least a sufficiency of albumin, to the more favorable climatic conditions of the temperate zones of Europe, it might be answered that China and Japan have, for the most part, the same climatic conditions. (According to Oshima, 75 per cent. of the Japanese are almost exclusively vegetarian.) Nevertheless, science in these countries is of a more contemplative and philosophic nature. Ingenious ideas, which open out a new horizon, and which advance the progress of mankind with giant strides, do not grow upon their soil. We see, on the contrary, the achievements of European scientists being accomplished with a bee-like activity and more and more extensively developed. New ideas, as, for instance, in the medical sciences, originate principally with the Europeans, and the Japanese scholars then carry on with unflagging industry most elaborate and difficult experiments. Medicine has been enriched by the Japanese in many of its branches, but in the creative field they have as yet accomplished but little. It may be assumed, however, that this will soon be the case, inasmuch as the Japanese are now learning to take a larger amount of albuminous food; the diet of the soldiers is especially well looked after in this respect.

In the nutrition of the central nervous system albumin also plays a rôle of the first importance as a distributor of energy. With an albuminous diet,—meat, fish, and eggs,—such elements as phosphorus and lecithin, which are indispensable for the building up and maintenance of the central nervous system, are also introduced. With a diet of rice, however, scarcely anything of these elements is absorbed, as the rice is usually, or at least by the majority, eaten without its outer coating; and it is precisely these husks that contain the most phosphorus.

To the above remarks I would like to add, in order not to be misunderstood, that I am not contemplating an unrestrained advocacy of an overrich albumin diet. Such a one may, as I shall show later, act very injuriously in all respects. My intention is rather to show that foods containing sufficient albumin are essential for intellectual attainments, and especially so when, in our schools, great mental efforts are required of the scholars during their growing period. I consider it my duty to emphasize this fact, in view of the tendency existing at present to undervalue the importance of albumin and advise against its adequate use. In the interest of the welfare of the people this must be combated with all the means at our command. As in all the departments of pathology and therapy, so also here the principle that both too little and too much of a necessary thing are injurious is not given enough consideration; the rational course is the intermediate one.

If lime and phosphorus are indispensable for the development of the supporting bony frame, they are so nonetheless for the development and maintenance of the central nervous system. The importance of phosphorus for the body is shown by the fact that probably no other mineral is so stubbornly retained by it as this one. That the mental functions are very greatly influenced by it is demonstrated by the fact that in the conditions in which this substance is eliminated in considerable quantities, *e.g.*, in Basedow's disease, acromegaly, osteomalacia, diabetes, and in certain phosphaturias, as in prostatitis, etc., not only does pronounced nervousness occur, but frequently also psychic disturbances, while, again, in many mental affections an increased elimination of lime and phosphorus may be observed.

When we now inquire how the increased outgo of phosphorus is occasioned in the above conditions, we must first look for the causes of the diseases mentioned. They lie, as is known, in alterations in certain ductless glands—the thyroid,

the sexual glands, and the hypophysis. It follows therefrom that these glands must also have a great influence upon the metabolism of phosphorus and of lime compounds. That this is actually so is shown by the work of many investigators. It was found by Roos that the excretion of phosphoric acid is increased when preparations of thyroid gland are taken, and is, on the contrary, diminished when the thyroid gland has been removed. Scholz, also, found that an elimination of phosphoric acid amounting to more than ten times the normal quantity occurs through the intestine when thyroid gland is given to patients with Basedow's disease. The conditions existing in osteomalacia teach us that similar conditions exist in connection with the sexual glands,—a fact to be referred to again later on.

It is therefore of great importance that there should be a sufficient quantity of lime and phosphorus in the food; when there is not, alterations in the nervous system occur. Thus, Grijns, Eickmann, Axel Holst, Nocht, and Schaumann have found that when there is a deficiency of phosphorus, in man as well as in animals, a degeneration of the peripheral nerves (polyneuritis) occurs, and that animals succumb under this condition (beriberi is also caused by a lack of phosphorus in the food), while they continue to live when phosphorus is given to them in their food. According to Hulshof Pol, beriberi can be cured, and likewise prevented, by the administration of a kind of bean, the kadjang-idoe (*Phaseolus radiatus*). Scurvy and Barlow's disease must also stand in relation to such conditions. When we wish to supply sufficient phosphorus to our bodies, we must use for this purpose organic phosphorus, and this is best in the form of an animal food rich in nucleins. At the same time we can by a nuclein-rich meat and fish diet cause a stimulating action upon the organ which regulates the use of the phosphorus in our bodies, which we shall refer to again later on.

Besides the intelligence, many other important functions, as sleep, for instance, are influenced by the food. After a heavy meal of meat, a feeling of drowsiness comes on; the sleep, however, is of short duration, and is easily disturbed. While during sleep most of our functions are quiet and but slightly active, the digestive organs nevertheless continue their work, and when aliments difficult of digestion have been taken at the evening meal the sleep is troubled; the same is the case when there is overacidity of the gastric juice. The formation of gas is also very disturbing when food rich in cellulose, tending to produce flatulence, has been eaten.

The function of sexual potency may also be dependent upon food. An ample flow of blood to the sexual organs and the regulation of this blood-flow through the influence of the nerves play an important rôle in the maintenance of the state of potency. With poor food the sexual impulse, or libido, is but little stimulated, and the fulfillment of the act is incomplete; with overfeeding, especially with meat and certain other foods, the sexual desire may be stimulated, though the accomplishment of coitus may be correspondingly less satisfactory, owing to certain nervous influences.

The influence of food upon the temperament is of great importance. We have already referred to the fact that nations leading a vegetarian life are of a peaceful nature. Nervousness and excitability occur much more rarely than with the Europeans, and the individuals are also much better able to control themselves, and do not at once betray in their appearance every emotion or passion. The meat-eating European does not appear to good advantage beside them in this respect; he is very nervous, easily excited, and does not take the trouble to control himself; he shows his bad temper at once. This is, however, a serious error in deportment in the eyes of the Orientals—and with perfect reason. Violence, insolent attacks, offences against the person through passion, occur much

more rarely among peoples almost or entirely vegetarian than among those living upon meat. If the main objective point of progress among mankind were peacefulness and quiet, and the life in common—as in Paradise—of wild and tame animals, without mutual annihilation, an exclusively vegetarian diet would be the best way to attain this result. A quieting influence is exerted upon the mind by such a diet, and violent criminals may be subdued by means of it. It is also to be noted that if we regard criminality as a variety of disease its cure is to be attempted with food of vegetable origin. Such food is actually given in many prisons. It may, however, also have an injurious effect, for we shall show later that tuberculosis is often developed upon this basis, so that the atonement for crime in this way often becomes too inhuman. This kind of undernourishment, furthermore, is not of a nature to exert a healing and improving effect upon the disposition, for it has an injurious effect upon the nervous system and the mind. The symptoms are very often aggravated in neurasthenia, if too little is eaten or the meals are taken too far apart; cramming with food—Weir Mitchell's treatment—may here do much good. The late Professor de Smet, of Brussels, gave such patients large quantities of lambic, an acid Belgian beer, to drink, in order to stimulate their appetites, and allowed them to eat bacon, eggs, and meat every three or four hours, until they were well fattened; the neurasthenics were nearly always benefited, and even more so hysterical women, who in fear of their nervous dyspepsia did not have the courage to eat, and were, in consequence, half-starved.

That the temperament is very frequently unfavorably influenced by undernutrition is certain. A cat which has eaten well purrs and is contented. A dog which has not had enough growls and is ready to bite. The average man, too, feels satisfied after having enjoyed a good midday meal, and is then in a good humor. Quite the contrary, however, when the repast

has not been to his taste, and he gets up hungry. Then he gets surly and grumbles; how true the English proverb is: "A hungry man is an angry man!" The same may be observed with respect to entire nations, and history shows us that hunger and need have often driven the people to revolutions, as, *e.g.*, in the great French Revolution. Statesmen who govern a nation can most easily bring about a contented condition among the people if they aim at giving them food of good quality at low prices; otherwise, the agitators have an easy task, and there is increasing discontent. As in the time of Rome, the people, even now, demand *"panem et circenses."*

Hunger and the sexual impulse constitute the driving power behind the activity of man and animals. How many crimes have been instigated by poverty and the resultant hunger! And, yet, these instinctive forces have their good sides, like all that is bad upon earth. They incite to work. If the farmer did not fear hunger and poverty, he would not till his field, and we would be deprived of our daily bread. Without need and hunger, much of the progress of mankind, and many a discovery and invention, would have remained unaccomplished. Necessity stimulates invention. Blessed be poverty, for without poverty there would be no riches! *The bad is necessary in this world, in order that the good may grow out of it.*

3. *The Influence of Foodstuffs upon the Teeth, Pharynx, and Vocal Apparatus.*

Of all the substances which are injurious to the teeth, acid saliva, as a primary factor, plays the most important rôle. This condition may be brought about by certain articles of food, such as sugar (Holz), which increase the acidity in the cavities of the teeth, injurious results following. A plentiful meat diet will also cause acid saliva. In addition to its other

prejudicial effects upon the substance of the teeth themselves, acid saliva favors the formation of tartar. When the tartar extends under the gum, the latter becomes loosened, and a pocket is formed which constitutes a welcome nidus for a variety of small organisms, suppuration therefore occurring around the neck of the tooth. This may cause the tooth to be irrevocably lost. It is precisely in persons who have the prettiest and most regular teeth that we most frequently see this most terrible disease of the teeth, *pyorrhœa alveolaris.*

According to Hermann, there may exist a predisposition to this affection, in the sense that it most frequently occurs in diabetics and those suffering from gout. Now, these diseases are very often the result of overnutrition,—overfeeding upon meat,—so that here also the acid property of the saliva plays a rôle.

If one wishes to protect the teeth, one must always wash out the mouth immediately after eating sugar, honey, acid fruits, fruit acids, grapes, or other fruits, and this is best done with a fluid containing some alkali, *e.g.*, with some alkaline mineral water, or water to which bicarbonate of soda has been added. Toothpastes containing alkalies may also act very favorably.

With a meat diet, it should be remembered that particles of the meat which remain between the teeth may easily become decomposed. A toothpick must then be carefully used; conforming with good manners, this is best done when one is alone. Antiseptic mouth-washes, odol, for instance, or, even better, hydrogen peroxide, can destroy the bacteria of decompositions. It is important to cleanse the teeth with a somewhat hard toothbrush after each meal.

The saliva itself exerts a cleansing effect on the buccal cavity and the teeth. Food substances giving rise to much saliva, such as hard bread, may also have a useful action upon the teeth. When much saliva is secreted, the acid resulting

from the previous use of sugar, for instance, may be counteracted through the alkaline property of the saliva. Chewing forms a splendid gymnastic exercise for the teeth, which are correspondingly strengthened by all such foods as require considerable mastication. Hard, black bread, rye bread, is particularly recommended by Roese for keeping the teeth in good condition. He also takes into account the mineral salts, such as lime, contained therein. I feel impelled to remark, however, in this connection that the action of the black rye bread in the intestine is not favorable, and that a rather large proportion of the nutritive salts, and consequently of the lime, is lost. The discovery of Roese, that drinking-water containing lime increases the alkalinity of the saliva, is worthy of note.

The amount of lime contained in the food is of the greatest importance in keeping the teeth in good condition,—especially during the period of growth,—since the teeth are principally formed of lime and magnesia. According to Roese, as stated above, drinking-water containing lime may act well here; he also mentions the interesting fact that, wherever such water is consumed, the population has fine teeth—yellowish-white teeth are the strongest; where the water is soft, on the other hand, one finds universally poor teeth. By the free use of lime-containing drinking-water, as well as of food substances containing much lime, such as milk, much good may be accomplished in the way of retention of the teeth.

The secretion of saliva is greatly stimulated by chewing, and this is not only beneficial for the teeth, but for the throat as well. In persons who have large tonsils these organs frequently become inflamed; the inflammatory condition, in turn, has a deleterious effect upon the throat, and consequently a chronic inflammation is developed. The secretion of a large quantity of saliva may here be of much benefit; it is helpful in these cases to use special chewing tablets, such as are much

employed in the United States, where gum is prepared with sugar and the various fruit extracts for this purpose, and used in very large quantities. I wish that I could create here a sentiment which would encourage the Austrian and German industries in the manufacture of this "chewing gum"; this would not only have a beneficial influence upon the throat and the tonsils, but upon the teeth as well, for which it would, with the increased flow of saliva, act as a cleansing agent. It would be necessary, however, that only pure ingredients, and in no case injurious substances, should be used. The use of chewing gum probably originated with the old Aztecs. I found in the British Museum, in the records of the Dominican monk, P. Bernardius Sahagun, who accompanied the Spanish conquerors to Mexico, that the prostitutes, in particular, continually chewed gum ("chicle"). They also had wonderfully beautiful teeth.

The various substances injurious to the teeth, especially acids, may be hurtful to the throat. Alkaline mineral waters are very useful, especially those of the nature of Ems water.

Of the acids, only the very acid fruits act injuriously; those less sour may, unless taken in very large quantities, be advantageous, since they act as a preventive against inflammation of the tonsils.

Certain fruits, such as the bilberry and the blackberry, are good for the throat, and they can be used combined with glycerin in the manner of the English "glycerin and black-currant lozenges" with much benefit. They are especially good for dryness of the throat, and also have a favorable action upon the voice.

A similar effect is produced by all of the mucilaginous and fatty food substances in general, such as glycerin, various oils and fats. The action of raw eggs is well known. Coarse and irritant foods, of a sandy or corn-like consistency, such as nuts, chestnuts, etc., are, on the contrary, injurious.

Honey, and sugar in various forms, *e.g.*, candy, while not exerting a good influence upon the teeth, act favorably upon the pharynx and the voice, especially when, as in the glycerin lozenges, the sugar is added to glycerin. The mucilaginous constituent of many pastilles, as, for instance, those made with Iceland moss, acts very favorably. Such mucilaginous lozenges, of a gummy consistency, may be made of the various algæ, and be employed for lubricating the throat when it is unduly dry, as well as for keeping the throat and voice in good condition. Malt bonbons likewise have a good effect by virtue of their expectorant properties.

Many articles of food, *e.g.*, cheese, act unfavorably upon the voice. Many singers do not drink beer for this reason.

Tobacco, and especially cigarettes, have a most injurious effect upon the throat and voice, and yet great singers like Caruso smoke. I have frequently seen Dalmores smoking cigarettes.

Alcohol is also injurious to the voice when taken in large amount. It may, on the contrary, when greatly sweetened with sugar, especially in the form of Swedish punches,—but only of the better kinds, not the "Banco,"—act quite advantageously upon the "timbre" of the voice, and make it clearer. At least, I have several times observed this effect. I certainly do not wish to imply, however, that the magnificent voices of the Swedish students' chorus and their masterly singing—probably the best among the students' choruses of the world—bear any relationship to their enjoyment of the national punch.

4. *The Influence of Food upon the Digestive Organs.*

When we examine the skull, found in the Neander valley, of the primitive man who lived so many thousands of years before us, we are at once struck by the colossal size of the jaws. It would appear that these were necessary in the prehistoric

man in order that he might be able to break up thoroughly the indigestible raw foods, not previously prepared by cooking, so that they could be of use to his body. The size of the jaws was here undoubtedly adapted to the nature of the food; it was a necessity and a consequence of the feeding upon foods which required much chewing, with the aid of strong jaws.

Whether another such adaptation existed in the length of the intestine, as we see it in herbivorous animals, remains undetermined. The teeth and the skeletons of these primitive human beings have withstood the ravages of time, but not so the softer portions of the body. That such an adaptation of the intestine existed is rendered probable by the fact that the length of the gut varies in animals of the same species, taken quite young and while growing, when some are fed exclusively upon plant food and the others mostly upon meat. This has been shown by the experiments of Babak.[1] The degree of variation may be quite considerable.

The same thing may be observed in humankind. In those who have, since childhood, been fed upon a diet consisting principally of meat, the intestine is shorter than in those who have subsisted upon a vegetarian diet. In the Chinese and Japanese the intestines are one-third longer than in Europeans. The Eskimos, on the other hand, have a very short intestine. The meat-eaters among animals have a very short and muscular intestine, in order to be able to propel the feces onward and to eject them, since they are not of a nature to excite of themselves any great movement in the intestine. In the herbivorous animals this condition is not necessary.

A similar state of adaptation to the physiological processes may be observed during the digestion, in particular in the fact that the gastric juice is secreted in different ways according to the quality of the food. When meat is eaten, for instance, the

[1] Cited from Madinavetia, "Physiologia Pathologica de la Digestion," Madrid, 1910.

stomach secretes hydrochloric acid in considerable amount, in order that the connective tissue may be readily dissolved. When bread is eaten a large quantity of pepsin is secreted, since, as we have learned through the experiments of Pawlow, bread requires five times as much pepsin as the albumin of milk, for instance. Bread thus makes great demands upon the gastric digestion, and black bread, furthermore, imposes the same requirements during the process of intestinal digestion. Milk, however, makes the least demands of any food substance, especially certain kinds of milk in which the caseous matter is precipitated in a more finely divided state, or where, as in kefir, it has been partially digested through the action of bacteria.

Food substances having a very pleasant taste may stimulate the secretion of the gastric juice merely by their appearance and sometimes, even, by simply being called to mind. When a dog is shown a sausage, a secretion of saliva may often be observed; in addition to this, however, large quantities of gastric juice are also secreted, but only after about five minutes. These secreted juices are ready to receive and to digest the food about to be taken. They are actually in waiting for it, and when the food is received it still further stimulates by its presence the secretion of these juices. When a roll with dry, brown crust is taken, the crust must be well masticated, the chewing further exciting the secretion of saliva. The saliva has for its object to assist the descent of the food through the alimentary canal, and after a large amount of saliva has been thrown out the food slips down all the more easily. The drier and harder the food substance is, the more saliva will be required, and nature has provided for this, for the saliva undergoes variations in accordance with the nature of the food, becoming more or less fluid, or of a viscid quality. The only requirement is that man should do his part, and thoroughly masticate hard and dry articles of food. The hard, dry crust

of a roll is more easily digested than the soft interior portion—leaving aside the fact that its starch has been rendered rather more digestible during the process of baking—because it is much more carefully masticated, and because a great deal of saliva is secreted during the process. The saliva is here of especial importance, since the ferment it contains, the ptyalin, plays a notable rôle in the digestion of starchy foods, converting, as it does, the starch into sugar, which is the only form in which starch is taken up and used in the body. All starch must be first turned into sugar, for only in this way, in the form of glycogen, can it be carried to the liver and there stored up.

The saliva also has another important function: it acts as an antiseptic upon many injurious substances which are taken into the mouths with our food. We can best observe in dogs that this is really the case. When a dog has a wound, he is constantly licking it. In the laboratories where I have been working, I have often observed that dogs lick the wounds after operations, and, as good comrades, they even perform this function the one for the other. Such wounds never become infected; severe wounds, such as those caused by the removal of the entire thyroid gland, healed without infection in a very short time. When dogs are prevented from licking their wounds, or when, on account of the situation of the latter, the dogs cannot reach them, they very readily become infected.

The stomach is protected against poisoning to an even greater degree by the hydrochloric acid. We very frequently ingest, especially while traveling and the temporary guests of unscrupulous landlords, a number of quite injurious substances in foodstuffs which are not fresh and have deteriorated. This can be observed in a marked degree in animals that have no careful guardians watching over them, and must take their nourishment wherever they can find it. Now, if these decomposed food substances do not hurt the animals, and if we are not harmed by game, etc., which already has a decidedly pro-

nounced odor, it is because of the hydrochloric acid contained in the stomach. We can easily convince ourselves of this fact by simple experiments. If we place some pieces of meat in a 4 or 5 per cent. solution of hydrochloric acid, about as it is in the stomach, they can remain there for some days at room temperature or can even be kept for a week or longer, without there being the slightest odor of decomposition. Decayed meat loses its odor after having been for a time in such a solution.

This property of the gastric juice may be lost in certain diseased conditions of the stomach. When, in addition, the motility of the stomach is seriously diminished and the food substances lie in the stomach for a long time, very injurious decomposition takes place.

A sufficiently acid gastric juice may prove very efficacious in protecting us against certain epidemics, *e.g.*, of cholera, by counteracting the causal factor of the same. Of course, the cholera germs are only then destroyed when the food in which they are contained excites the secretion of stomach acids. When a little fruit containing these micro-organisms, or a glass of infected water, has been taken, either of which will excite only a very slight secretion of acid, no active protection can be expected: a sufficient quantity of meat would have to be taken at the same time. When there is danger of cholera uncooked foods should never be taken upon an empty stomach.

In addition to the above-mentioned property, the acid of the gastric juice also possesses another very important one, namely, that of making the digestion of food possible. This duty, however, seems to be less important than the first mentioned, for when the stomach fails the digestion can be accomplished by the intestine. But should the stomach acid fail, then both animals and man would be in constant danger of being poisoned by an unsuitable food substance. For the digestion itself, the acid is indispensable, for it alone is capable of causing the pepsin in the gastric juice to dissolve the

albumin. Pepsin is not given off as such by the main cells of the stomach glands, but rather in a preliminary form, as pepsinogen, and it is then converted into pepsin by the hydrochloric acid of the surrounding cells. Gastric digestion can only be performed by the combination of the two. The hydrochloric acid alone might perhaps exert a softening action upon the albumin, *e.g.*, upon fibrin; it can also dissolve the connective tissue of the meat-fibers and the cellulose of vegetables, but it is only in association with pepsin that it can dissolve the albuminous substances, such as meat or hard-boiled eggs, and convert them into peptone, in which form the albumin is taken up in the body. About 25 to 35 per cent. of the albuminous substances which are peptonized in the stomach may be absorbed by the stomach. All the rest goes into the intestine, and there the peptone is very quickly converted into the amino-acids by a ferment, erepsin, discovered by Cohnheim, which is present in the small intestine in the pyloric region, as well as for a short distance lower down.

With the exception of a portion of the peptones, only a very few foodstuffs are absorbed by the stomach. Alcohol is one of those which are, and sugar is also taken up in small quantities. Water is not absorbed by the stomach, but after remaining there for a time passes into the intestine. Very often a pint of water may remain in the stomach for half an hour. When the stomach is diseased, and the peristaltic action is greatly diminished, water may remain in it for a very long time, sometimes two to three hours. In such cases one can hear, upon percussion of the stomach, a "splashing" of the water for quite a long time after it has been taken. Jaworski has shown that, as a rule, hot water disappears from the stomach much more rapidly than cold water.

The temperature of liquid nourishment, in general, and of water or soup, is not without importance for the stomach, and in many persons much harm may be done by either very

cold or very hot drinks. Boas states that many stomach troubles are caused by the habitual use of either very hot or very cold drinks. Among Americans, colic occurs very frequently, and this may perhaps be due to the custom, which I have myself observed during frequent visits in the United States, of serving water with pieces of ice in it at each meal, even during the winter.

The direct action of the food substances upon the mucous membrane of the stomach is also of importance in digestion. We have already mentioned above that the sight or even the thought or recollection of some very tasty article of food will induce a secretion of gastric juice. The digestive process is thus set in motion, and when the food is taken it is at once brought in contact with the digestive fluids. The food, in its turn, acts upon the mucous membrane, and in this way the process of digestion is continued. The action of different kinds of food varies. Among the most stimulating are meat extracts, and for this reason it is indicated to give a good meat soup to persons suffering from loss of appetite, and to those in whom the psychic secretion of gastric juice is diminished owing to a depressed, melancholic condition. Caviar acts in much the same way.

Alcohol has a considerable stimulating effect upon the secretion of the gastric juice; a diluted alcohol, however, is most efficacious. It is to be remembered that the gastric juice thus secreted contains but little ferment, but, on the other hand, an increased amount of hydrochloric acid. Persons suffering from overacidity of the stomach would do much better not to take any alcohol. Very strong alcohol, like poisons in general, stimulates the secretion of the gastric mucus as a sort of protective measure; strong spices, aromatic substances, mustard, etc., also act in this way.

In certain countries it is the custom to take some strong alcoholic drink just before meals; in France the "apéritif,"

containing much alcohol, and in Sweden and Denmark "aqua vitæ" are thus used. According to the statement made above, this is not a rational procedure, and represents a sort of "box on the ear" for the stomach, which is really only irritated thereby. Often such a method is merely the final resort to renew the digestive functions in those who have, through gluttony, lost the power of normal stimulation of the digestive process. Meat excites the secretion of the gastric juice, which contains much acid; during the digestion peptones are formed, and these, again, further assist the digestion in precisely the same way as does Liebig's extract. For the digestion of bread an excessive secretion of acid would be injurious, since the digestion of the starches would be thereby arrested; consequently, with a bread diet the stomach secretes a great deal of pepsin, but very little acid. To be sure, an equal amount of the psychic secretion of gastric juice may occur with bread as with meat, but, after a short time, the flow of juice excited by the bread will gradually cease. Meat from which the extractive substances have been removed by boiling causes but a slight secretion of juice.

Water and also milk stimulate the secretion of gastric juice, but the flow induced is relatively slight. Through the intermediary of the pepsin contained in the stomach the casein is precipitated; the fluid portion of the milk passes into the intestine, like liquids in general, and the albuminous portion is dissolved in from two to three hours. White of egg excites only a very slight secretion of gastric juice, and for this reason raw eggs are not easily digested. In many cases hard-boiled eggs are better digested.

Stimulation of the flow of gastric juice by means of water may be useful in cases where the psychic secretion does not take place owing to a depressed mental condition, as in neurasthenia. It is also to be observed that one may stimulate a failing appetite by the aid of a drink of water, especially of a

kind containing carbonic acid, as do many mineral waters. In many cases alcoholic drinks exert even a better effect. In soups, not only the meat extractives contained, but the watery contents as well, have a stimulating effect upon the secretion. One may thus truly say "L'appétit vient en mangeant"—The appetite comes as we eat.

Since starchy foods take up but very little acid in the stomach, their digestion being thereby interfered with, it would be rational to forbid such a diet (with much bread, etc.) in the case of persons suffering from overacidity of the stomach. On the other hand, the meat in the diet must be restricted when the stomach does not secrete any acid, as is the case in many instances of chronic catarrh of the stomach. A meat diet, as already stated, requires principally hydrochloric acid; when this is lacking, a diet consisting of chiefly macaroni, rice, sago, or tapioca should be advised. These substances, even in healthy persons, simply pass through the stomach, and are then digested, first by the pancreas and afterward the intestine, and finally converted into sugar. We, therefore, advise this variety of diet in these cases in order to spare the stomach and leave the work to the intestine.

The hydrochloric acid also greatly influences the length of time that the food remains in the stomach, since it has an especial action upon gastric peristalsis.

The transit of the foodstuffs from the stomach into the intestine is accomplished through the movements of the muscles of the stomach, which, in a way, shake and stir up the gastric contents. When the food partaken of during a meal passes into the cavity of the stomach, the fundus, it forms an agglomerate mass. Its digestion can only take place as the juices secreted by the glands of the stomach, viz., the hydrochloric acid and the pepsin, act upon it. The muscular movements of the stomach bring about the contact of the digestive juices with the food. When this has lasted for a certain time, and the

food is sufficiently prepared, it is pushed toward the outlet, in the direction of the pylorus. In the pyloric antrum the movements become much more energetic; the food is here thoroughly kneaded and compressed, and converted into a finely divided, pulpy mass. In some animals which feed upon hard grains, *e.g.*, turkeys, the musculature of the stomach is capable of exerting pressure sufficient to crack nuts. In the feeding process of mankind, at least at the present time, such very violent action is no longer necessary, but sometimes considerable work is still required of the stomach in order to compress large indigestible masses, which, as a rule, cannot pass into the pylorus if they are at all larger than a plum, for instance. If too large they are pushed back, and it sometimes happens that several attempts have to be made before some such indigestible mass can succeed in passing; in the mean time the fluid portions of the food have already been discharged. We may imagine what an effort is required of the stomach muscle in consequence of the carelessness of hasty eaters and gormandizers! The importance of thoroughly masticating the food thus becomes evident, for which, of course, a good chewing apparatus is a necessity.

The work of the gastric musculature, as above described, is greatly assisted by the hydrochloric acid contained in the stomach. The acid excites the contractions of the muscles, and regulates the opening of the pylorus: when there is a sufficient amount of acid the muscles bring about a contraction of the region of the pylorus, the opening of which is therefore closed. The food can then be sufficiently digested, whereas, if the pylorus should remain open, it might happen that the undigested food would pass through. The more the acid penetrates into the intestine, the longer the pylorus remains closed. It is necessary that the acid contents passing into the intestine be first neutralized by the alkaline fluids of the latter, for otherwise the very important function of intestinal digestion, which

only takes place in an alkaline reaction, would be interfered with. When the acid has been sufficiently neutralized, the pylorus opens and allows another portion of the stomach contents to pass through. Thus, as we see, this work is accomplished gradually, which has the advantage that the various digestive fluids may act for a long time. When there is a large amount of hydrochloric acid in the stomach, it may happen that the contractions of the muscles become cramp-like. In such cases a fatty diet may prove beneficial. The fat, indeed, acts in a manner opposite to the hydrochloric acid: it stops the peptic digestion and the secretion of gastric juice, and exerts an inhibiting influence upon the musculature of the pyloric region. In overacidity of the stomach it is desirable to prescribe fats, and these best in the form of unskimmed milk or cream, as recommended by H. Strauss. When the fat is given in association with albumin, as, for instance, in fat pork or goose-meat, the fat exerts a restraining influence upon the musculature, while the albumin, through stimulation, causes closure of the pylorus, so that the food remains in the stomach for a longer time, as we will show later in a table showing the periods required for the digestion of various foods.

In addition to the above-described functions of the hydrochloric acid another very important one must be added, viz., the influence of the acid upon the digestive processes taking place in the intestine.

When the hydrochloric acid passes into the intestine with the food from the stomach, it comes into contact with the epithelium of the glands situated in the mucous membrane of the intestine. Here it acts upon a substance called prosecretin, discovered by Bayliss and Starling, and transforms it into secretin. This, again, either through the agency of the circulation by which it is carried to the pancreas or through the nerves, acts upon this gland, causing the secretion of its juice. The latter only acquires its proper activity when the hydro-

chloric acid has reacted upon a substance, discovered by Pawlow, contained in the intestinal mucous membrane, namely, prokinase, and has transformed it into the active ferment, kinase. Without this substance the pancreatic juice has no influence whatever upon the albumins; as soon, however, as it comes in contact with the latter, digestion takes place very rapidly. Ferments, in general, are peculiar in that they have the power to cause rapid chemical changes, and that a minimum portion of ferment is sufficient to effect such changes in large quantities of other substances. Through the activity of the kinase the primary representative of a substance contained in the pancreatic juice, protrypsin, is transformed into the active substance, trypsin, which then carries on the digestion of albumins to its end-products, the amino-acids.

A very active ferment of this variety, which digests the peptones formed in the stomach further until they become amino-acids, exists in the mucous membrane of the duodenum and the upper intestine—it is also found in the mucous membrane of the pyloric region. It was discovered by Cohnheim, and was named by him erepsin.

In addition to the trypsin, two other important ferments are contained in the juice secreted by the pancreas: pancreatin or amylopsin, which converts the carbohydrates into maltose, and also a small portion into sugar,—and steapsin, which, however, is only rendered active by the acids contained in the bile and then proceeds to digest the fats. Fats in their usual form cannot be incorporated in the fluids of the body; they must first become liquid, when not naturally so. The solid fat, *e.g.*, that found in the muscular fibers, must first be fluidified—it must melt, and, the lower the melting point is, the more readily the fat can be made use of. Fats which already contain fluid oils, such as olive oil and other vegetable oils, are easily digested, as is also butter, which easily becomes fluid. On the contrary, fats such as lamb-fat, which only melts at a temperature ex-

ceeding 50° C., are digested with difficulty. In fact, all fats the melting point of which is above 40° C. are hard to digest.

Even when the fat has been melted and is fluid, it cannot yet be digested, since it is not soluble in water. It must first be rendered soluble, and this is accomplished solely by the steapsin, a ferment of the pancreas. This ferment splits the fat into glycerin and fatty acids. The glycerin is soluble, and the fatty acid is converted into soapy substances by the salts contained in the bile, together with the alkaline compounds of the intestine—among which is a certain amount of sodium carbonate. These soaps alone are soluble. After the component parts of the fat have been absorbed by the mucous membrane of the intestines, it is again built up from these same constituents, and becomes the body-fat of man or of animals.

The co-operation of the bile is absolutely necessary for the absorption of the fats. When the former is absent, as, for instance, when the orifice of the bile-duct is occluded by gall-stones (jaundice thereby also resulting), the greater part of the fat remains in the intestine without being absorbed. Such patients must not be allowed to take any fats. According to the experiments of Brugsch,[1] 40 per cent. of the fat is found in the feces when the flow of bile is obstructed. When, in addition, the action of the pancreas is also interfered with by a pathological condition, which usually occurs after long-continued gall-stone disease, the loss of fat may amount to 60 per cent. In one case, cited by Umber in his textbook,[2] in which there was no outflow of bile or pancreatic juice whatsoever, only a minimal quantity—10 per cent.—of the fat was absorbed.

Having explained the action of the three ferments which originate in the pancreatic gland, I would like also to mention

1 Zeitschrift für klin. Medizin, 1906.

2 Umber: "Textbook on Nutrition and the Diseases of Metabolism," 1909, p. 38.

that the various forms of nourishment act in different ways upon the secretion of the pancreatic fluids. Water, for instance, has an influence, even though rather a slight one, upon the secretion of the pancreatic fluid.

As Pawlow has shown, the pancreatic fluid contains a large amount of those ferments which are most required by and correspond with the food which has been taken. When, for instance, an animal lives exclusively upon meat and fat, the pancreatic ferment which converts the carbohydrates—amylopsin—will be lacking, and I question whether a similar condition does not exist in diabetics, who frequently live, in an irrational manner, upon meat and fats alone, to the exclusion of the carbohydrates.

The secretion of the bile is also greatly affected by the nature of the food. A meat diet causes a considerable flow of bile, as do also fats; consequently, fat in large quantity, olive oil for instance, is given in disease of the gall-bladder with impacted gall-stones and in attacks of colic.

The presence of the bile in the intestine is of the greatest importance for the digestion, since it not only activates the fat-splitting ferment, but causes the two other ferments of the pancreatic gland to act more quickly and powerfully. The bile also exerts an influence upon the propulsion of the contents of the intestine, and its absence is generally followed by constipation. The intestine, of course, also has a movement proper to itself. By wave-like contractions, such as we see in earthworms, it pushes the contents downward toward the external orifice. In this manner, the ferments of the fluids secreted by the intestinal glands are enabled to exert their full activity, especially the maltase, which completes the conversion of the starches into sugar. The saliva and the secretion of the pancreatic gland do not have as pronounced an effect upon the carbohydrates as the intestinal fluids: they only convert a small portion thereof into sugar, while the rest forms dextrin

and maltose; the maltase thereupon acts on the latter and transforms them into grape-sugar (dextrose). It is this substance alone which is capable of being taken up into the system to be stored in the liver in the form of glycogen. The starches and their colloid intermediate products cannot be thus taken up. Cane-sugar must also first be split into dextrose and levulose. This is accomplished by invertin, a ferment present in the intestine. In animals, or in persons living upon milk, another ferment is found in the intestinal juice, viz., lactase, which converts the milk-sugar into galactose and dextrose (grape-sugar).

In addition to these ferments, which act upon the carbohydrates, the intestinal juices contain another ferment, already mentioned, erepsin, which acts upon the albumin. In order to bring the ferments present into intimate contact with the contents of the intestine, the latter performs a series of pendulum-like movements.

Various kinds of food exert special influences upon the movements of the intestine. Fatty foods, for instance, arrest the gastric and intestinal movements. Very large quantities of fat, however, have a rather irritating effect, like castor oil. A diet of lean meat only slightly excites the movements of the intestines, so that the contents move forward less rapidly, and during this time can be well absorbed. When the contents, on the other hand, include a large amount of residue, as in a vegetable diet, too great an irritating action is exerted upon the intestinal mucous membrane, and the intestine is too rapidly freed of its contents. When this is the case the food, naturally, cannot be well assimilated, and the principal function of the intestine, that of absorbing the food substances and rendering them available for the benefit of the system, is not carried out.

The question of the assimilation of food in the intestine is a very important one, and will be taken up later. I shall

simply mention here that when the food has not been sufficiently cooked, is insufficiently masticated, and insufficiently digested by the gastric juice the intestine must alone perform what has been left unaccomplished. It may then readily happen that a portion of the food which should be absorbed is lost.

The development of local diseases is also greatly favored when the intestine is continually required to perform such excessive work. Then, too, the food itself is not always in perfect condition when taken (*e.g.,* unripe fruit).

When we speak of an easily digested food we must differentiate between digestibility in the stomach and digestibility in the intestine. Calves' brains, for instance, are readily digested in the stomach, whereas in the intestine 43 per cent. thereof, which cannot be digested, is lost, as has been shown by Rubner. On the other hand, a hard-boiled egg is less perfectly digested by the stomach than by the intestine; the latter succeeds much better with the hard egg than the stomach. Many food substances are digested with difficulty both by the stomach and the intestines, *e.g.,* the leguminous vegetables. In these, the outer husk, the celluose, covers the nutritious elements, the starch and the albumins, contained in the cells, and prevents their digestion. It may therefore happen that a considerable portion of the albumin as well as of the starchy contents of such vegetables is lost. In other vegetables again, quite a large part of the proteid and starchy contents, as well as of the nutritive salts, may be lost owing to imperfect digestion of the cellulose, and also because, as we have already mentioned, they give rise, by virtue of their cellulose content, to increased activity of the intestinal movements. It would seem to me that the disciples of vegetarianism, in judging of the nutritive value of their diet, do not give sufficient consideration to the assimilative capacity of the intestine.

With a vegetable diet, much, if not all, depends upon the capacity for digesting cellulose. Animals are much better off

in this respect than we are, since they have a specially adapted ferment, zylase, in their very large cecum. This ferment is absent in man, and is replaced by the intestinal bacteria, the various fermentative fungi we take in with the air ingested while eating and drinking, and in the food itself. These organisms act upon the cellulose in such wise that about 30 per cent. of it becomes soluble. Cellulose in general does not furnish any considerable amount of nourishment to us; yet, a portion of it may be assimilated. Through the action of the bacteria, not only are the useful nutritious substances inclosed in the cellulose set free, but also small amounts of fatty acids are formed by cleavage of the cellulose, such as acetic acid, butyric acid, etc., which also represent a certain nutritive value. Together with these, gases are formed. While an excessive quantity of gas is of no advantage, yet it exercises a stimulating effect upon the intestinal movements and favors the evacuation of the contents.

The bacteria of the intestine, however, also exert their decomposing action upon the albumin, and, in fact, upon any constituents of the food which have escaped digestion by the gastric and intestinal juices. When a person has ingested a large quantity of meat, it may happen that a portion of it will reach the large intestine still undigested, and here the bacterial action will very decidedly come into play. The body, however, cannot derive any nutritive benefit from the action of the decomposing bacteria upon the albumin in the large intestine, for, even though the resulting products may be absorbed, they are not assimilated in the same manner as other albuminoid nutrients, but, on the contrary, may exert an injurious and even poisonous action. Indeed, the general symptoms occurring after long-continued constipation, such as headache, nausea, mental depression, loss of appetite, etc., may be referred to the absorption of such poisonous products. The decomposition of albumins is greatest when the food remains a long time in the

intestine, as is the case in constipation. It may be diminished by laxative mineral waters, since these shorten the time during which the food substances remain. The lactic acid bacilli act in the same way; they ferment the sugar contained in the foods and carbohydrates, form lactic acid, and disinfect and destroy the bacteria of decomposition. Any food rich in milk or sour-milk products, such as jogurt, kefir, etc., will restrict the processes of decomposition in the large intestine. According to Winternitz, decomposition may be entirely or almost entirely prevented by a milk diet.

During their progress through the intestine, all the fluids and other portions of the food which are capable of being absorbed are taken up, and, the farther the mass progresses downward, the more its liquid constituents are given off, until only the dry feces remain. The longer the feces remain in the intestine, the harder they become. When the diet consists principally of meat, the feces tend to be dry, but with more carbohydrates, especially in the form of sweets, they are more liquid. The carbohydrates cause fermentative changes which exert a stimulating effect upon the intestine, and cause the evacuation of the feces before they have had time to lose their fluidity. The result of this is, however, that the food substances are incompletely absorbed. While such starchy masses may induce diarrhea because of the fermentative processes, the dry condition of the stools produced by a meat diet may, on the other hand, cause constipation.

When there is too great a quantity of starch, a portion is usually found undigested in the stools. A diet containing a moderate quantity of starchy flour is best assimilated in the intestine, especially in the form of sugar, so that no trace of it is found in the feces.

The feces, in addition to the residue of the food, consist largely of the secretions of the intestines and of bacteria. Portions of the food may also be found, such as pieces of meat

which have not been sufficiently masticated, elastic fibers, gristle, tissues, cells, and likewise the undigested husks of the cereals, which still contain albumin or starch granules, which, owing to insufficient cooking or faulty digestion, have remained intact. Certain food substances sometimes pass through the intestinal canal completely undigested. Only recently I found in the stools of a little girl of 6 years peas which had been eaten five days before, and had remained in their original form, entirely undigested, after an attack of colic and diarrhea. They had been swallowed unmasticated. Children should therefore never be given such indigestible foods unless the latter have been previously mashed up, as they have not yet acquired the habit of proper mastication. Children, and often hysterical or mentally affected adults, often swallow much more indigestible substances, and occasionally pointed objects, such as needles, without causing any injury to the intestines. Madinaveitia[1] lately found in the stools of a woman a needle which had been swallowed some little time before, and had not given rise to any trouble. That such things are possible has, moreover, been shown by the experiments of Exner. He caused dogs to swallow needles and other pointed objects, all of which were afterward found in the stools. Exner showed that the presence of such objects caused a change in the shape of the intestine, which expanded to form a cavity in front of them, thus, one might almost say, running away from them. It would seem, consequently, that the throat and upper portion of the alimentary canal are more often injured than the intestines themselves after the swallowing of such foreign bodies.

As soon as the feces in their progress toward the external orifice have reached the colon, they exert pressure and irritation thereon, causing contraction of the gut and expulsion. This is a usual occurrence in persons who are normal, but there are many, especially young girls, who do not at once respond

[1] Madinaveitia: *Loc. cit.*

to this call of nature, thus causing the feces to remain a long time in the colon. The continuation of such a practice may induce such an habituation on the part of the bowel to its contents that their stimulating influence is lost. Obstinate constipation then results. This is most frequently found in women, as a consequence of this pernicious habit, and they are then obliged to resort to daily injections. I very frequently meet with such cases in my practice, especially among my French and American patients. Without their "enemas" these ladies never have a passage, unless they have been cured by a special treatment. It is therefore advisable that the call to void the stools be instantly followed whenever possible. When the intestine has lost the habit of responding to slight stimuli it becomes necessary to resort to very strong ones, in order to whip it up, as it were; this is generally accomplished by resorting to injurious evacuants, which must then be constantly used.

Before closing this very important chapter, I would call attention to the decided influence of the condition of the mind upon the digestion.

In the process of digestion the mental state is of great importance. As with all the functions of the body, it is necessary to enter into it heartily, *i.e.*, help it along; otherwise, it will be interfered with. This is especially well shown by Pawlow's experiments on dogs. A lively, hungry dog, which gives its entire attention to its meal, entering into it body and soul, secretes large quantities of gastric juice, while a dog the attention of which is diverted, and which plays about while eating, will produce but little of it. The same thing occurs in man; children should, therefore, be strictly forbidden to play while eating—in fact, they should not be at all disturbed during this time. For, as has been shown by Pawlow's experiments on animals, it is not only upon the gastric digestion that such disturbances act unfavorably, but also upon the digestion which takes place in the intestines, and the propulsion of the

food therein. In man one may observe the same effect, and the satisfying of such an imperative demand as that of hunger should be accorded the full attention, if injurious results are to be avoided.

5. *The Influence of Food upon Other Important Organs.*

After the food has been prepared and taken up by the blood, as described in the preceding chapter, it is carried to the liver by the portal vein. Here the most injurious and poisonous substances are destroyed by the liver, or are transformed into innocuous compounds. Poisons which have not been broken up by the action of the hydrochloric acid can be destroyed by the liver, and it is for this reason that poisonous substances which would cause certain death if absorbed through the skin lose their effect when taken into the stomach. Thus, for instance, the venom of many snakes which causes instant death through a slight wound of the skin is, when swallowed by the mouth, quite harmless. The liver is one of our most powerful detoxicating organs, and, in order to enable it to carry out this function successfully, the quality of the food taken is of importance; when the nourishment is insufficient, or when there is not a sufficient quantity of albumin, the liver, as the experiments of Roger and Garnier have shown, is unable to do its work. The poisons combine with the albuminoid bodies of the liver, and, consequently, animals which have been given large quantities of albumin are much better protected against poisoning by metals, such as quicksilver, by arsenic, and by various alkaloids than other animals not so treated. When the liver has been kept long at work in antagonizing poisons such as alcohol, tobacco, etc., its integrity suffers. Inflammatory processes may occur in this very important organ, causing the loss of its protective tissues. The poisonous

end-products of the metabolism of albumins are themselves rendered non-toxic by the liver, and the ammoniacal compounds are excreted in the harmless form of urea. This ammonia-detoxicating function of the liver is of the greatest importance for us. In severe diseases of the liver it is naturally much impaired, and it then becomes advisable to refrain, in so far as possible, from a diet containing albumin.

In addition to the formation of urea, the liver also plays a major rôle in the metabolism of the carbohydrates. As we have seen, the carbohydrates, such as starch, are first transformed into grape-sugar. This is then carried into the liver by the portal vein, and the sugar is there stored up as glycogen. Thus, the liver forms a sort of preliminary storehouse for the sugar needed by the organism. The glycogen is given out as it is required, is transformed into sugar by a ferment contained in the liver, and is, as such, excreted and carried into the tissues. Here it is again stored up in the muscles, so that both the liver and the muscles accumulate the sugar in the form of glycogen. When the muscles are required to perform any sort of work, they give up the glycogen for this purpose. Muscular work is thus carried out through the agency of the carbohydrates. After prolonged and fatiguing labor, the liver contains only a small amount of glycogen, as it gives off its reserve of that substance much more freely than the muscles. In hunger the same thing occurs. It should be mentioned that the liver forms the glycogen not only from the carbohydrates, but also from the albumins; some forms of albumin, *e.g.*, egg-albumin, embody molecules of carbohydrate. The liver is also a laboratory or preparatory room for the fat which is carried to it with the food by the portal vein. When sugar is not burned up and is not voided with the urine, so that it is still available for subsequent use, it is converted into fat, and this process is likewise carried out by the liver.

Another substance of great importance in digestion is formed in the liver, viz., the bile, the functions of which we have already described.

From the liver the substances which are to serve as food for the body pass with the blood through the lower vena cava to the heart. This important organ is also influenced by the quality and quantity of the food. When, for instance, large quantities of fluids are taken, it is placed under greater stress. When such excessive amounts of fluid are carried to the heart during a long period, they may cause structural changes, such as induration of the musculature, and later on a dilatation of its cavity, such as we see in the so-called "Munich beer heart." A diet too rich in albumins and containing a considerable amount of extractives, as well as a continued rich diet in general, may also affect the integrity of the heart. For the action of the heart muscles as well as for the muscles in general, a carbohydrate diet is the best. Alcohol and coffee or tea in large quantities and after long-continued use may also exert a very injurious influence upon the heart.

Such errors in diet are very harmful to the blood-vessels. The pressure in them is augmented, and when a high blood-pressure is maintained for a long time the production of arteriosclerosis is greatly favored. The decomposition products resulting from a diet rich in albumins, along with the extractives simultaneously contained in the blood, cause very serious results after their action on the vessels has persisted for some time. According to Huchard, Senator, and others, arteriosclerosis is very readily produced in this way, and many cases are certainly due to an injudicious one-sided diet.

Overindulgence in coffee and tea may cause a change in the tonus of the blood-vessels, and the constant dilatation will cause untoward effects, as described by Romberg. Tobacco, in particular, has a most injurious action upon the walls of the blood-vessels, and a great many cases of arteriosclerosis are

due to its use. Alcohol, too, when continuously and considerably indulged in, is harmful to the blood-vessels. Large quantities of fluid, by overloading the vascular system, are most hurtful to the organism.

Food exerts a marked influence upon the constitution of the blood itself. Excessive amounts of fluid may cause a dilution of the blood owing to the absorption of the water; this, however, is of short duration, as the fluid which has been taken up is soon excreted. On the other hand, it is conceivable that, when such quantities of fluid are habitually absorbed, more permanent dilution of the blood, and a watery condition of the tissues, may result.

With too dry a diet, the blood may become inspissated. When a large quantity of hot tea is taken, causing excessive perspiration, the same result may be produced; but such a thickening of the blood will be of short duration. The fluid contained in the tissues is then drawn out, a condition which is also observed after severe hemorrhages.

Dilution of the blood may also occur, as has been shown by the very exact experiments of Grawitz, when the diet is insufficient and too poor in albumin.[1]

In regard to the effect of diet upon the condition and the composition of the blood, we here see manifested, as almost universally in the nutrition of man and of animals, the principle that the amount of the individual constituents of the blood depends in large measure upon the quantity of such substances ingested in the food. The blood contains more albumin than it does carbohydrates and fat. Many nutritive salts, however, are also to be found in it; the blood of pigs, indeed, is especially rich in iron.

The albumin-content of the blood plays a very important rôle, and when too little of this substance is carried into the blood from the food very injurious effects may result. As we

[1] Grawitz: "Pathologie des Blutes," S. 237.

have seen, the blood-serum becomes too watery, and the red corpuscles are also impaired. When animals are fed upon meat, the hemoglobin content is increased;[1] on the other hand, Bischoff and Voit found that by placing carnivorous animals upon a bread diet the blood was rendered more watery.

Leichtenstern, by researches carried out on his own blood, showed that a considerable increase of the hemoglobin content of the blood took place upon a plentiful diet.

While an insufficient supply of albumin is prejudicial to the composition of the blood, an overgenerous supply, on the other hand, may result in the formation of considerable quantities of injurious constituents, such as uric acid. This is invariably produced in large amounts with a generous meat diet, especially one rich in cell nuclei, *i.e.,* consisting of the glandular organs, liver, sweetbreads, as well as brains, etc. Not only meat, but many vegetables as well, and especially the leguminous varieties, may have an injurious effect, owing to the "purin bases" contained in them, from which the uric acid is formed. Tea and coffee have the same effect. We shall later refer to this in greater detail, and present a table of the content of uric-acid-producing substances in the various articles of food.

The blood also contains a certain quantity of sugar, not usually exceeding 0.1 per cent. When, however, an excessive amount of sugar is taken at one time it may happen that the sugar will not all be taken up by the liver, and the excess will then, since it cannot be so rapidly consumed, be excreted as a foreign body by the kidneys.

In many persons this may occur even after the ingestion of articles of food rich in starch, and when this takes place very often we have to deal with diabetes mellitus. The combustion of sugar, as well as its storing up in the liver, is regulated by the pancreas through the agency of a ferment which is probably

[1] Verdeil and Subbotin: Cited by Grawitz.

secreted by an epithelial structure of the islets of Langerhans present in the pancreatic tissue. When the pancreas is removed, diabetes is certain to occur.

The food also exerts a great influence upon the circulation of the blood in the vascular system.

The friction of the blood during its passage through the lumen of the blood-vessels is said to be greatly increased by a diet rich in albumins (*i.e.*, meat), as shown by the experiments of Determann. Alcohol, tea, etc., have the same effect.

Whether, on the other hand, a diet rich in uric acid will impart to the blood a viscid consistency,—collemia,—as claimed by Haig, has not yet been proven experimentally.

The various constituents of the food are carried to the organs of the body by the blood, and the products of their transformation, such as urea, together with various poisonous and injurious substances which have not been destroyed by the liver, finally reach the kidneys, and are here eliminated from the blood. Alcohol, strong spices, etc., thus exert their harmful influence upon the lining epithelia of the urinary canals, a certain portion of these cells being naturally lost, as is shown by the presence of hyaline casts in the urine. Indeed, we should always remember that everything we eat must pass through the kidneys, and may there prove injurious. Even in the process of excretion of the wastes from our ordinary diet, particularly an albuminous diet when it contains many extractive substances, the kidneys, after the steady work of many years, may suffer injury. A meat diet, owing to the nature of the end-products formed, imposes heavier work upon the kidneys than does a diet of vegetables or one consisting principally of milk;—much more urea and uric acid is secreted in the former case. When the work of the kidneys is not fully performed, the excretion of uric acid is accomplished with difficulty, and gout develops easily.

An overgenerous meat diet may also give rise to diabetes, probably through its influence upon the thyroid gland (Lorand). The thyroid greatly influences the metabolism of sugar, since, as I have shown, sugar is oftenest excreted when the thyroid gland is overactive. On the other hand, very large quantities of sugar may be taken without any alimentary excretion of sugar when the thyroid gland is degenerated.

The excretion of sugar resulting from overactivity of the thyroid is not only induced by large quantities of sugar or very starchy foods, but also in the absence of carbohydrates when a meat diet is taken. When there is an abundance of thyroid secretion it causes disintegration of the albumin, and much more sugar may be formed than the amount corresponding to the carbohydrate molecules of the albumin; we must therefore admit the presence of a toxic irritation of the tissues. When the pancreas is active this sugar excretion may only be temporary, but when it is incapacitated by disease permanent diabetes is developed. As I have proven experimentally, there exists a kind of antagonism between the thyroid and the pancreatic gland, so that when the pancreas is removed the thyroid becomes overactive; when, however, the thyroid gland is extirpated, the pancreas shows an increase of the islets of Langerhans, which, as has already been mentioned, probably regulate the consumption of sugar in our bodies. As I have previously demonstrated, diabetes is caused by one of two factors: 1. Degeneration of the pancreas. 2. Overactivity of the thyroid gland.

The excessive activity of the thyroid gland may be caused by a faulty diet, which can in this way cause diabetes, especially when there is an inherited tendency. A meat diet containing many extractive substances exerts, as has been shown by the experiments of Breisacher, Blum, and Chalmers Watson, which will be further referred to later, an irritating influence upon the thyroid, and in persons who continue for

years to eat too much meat, and besides indulge to excess in sweets, diabetes is easily developed.

The thyroid also greatly influences the metabolism of fats, and we may say, in general, that it, in connection with the other ductless glands, in fact regulates the metabolic processes of the organism; it acts, as von Noorden says, as a kind of bellows for the processes of combustion. When the thyroid is degenerated and inactive, obesity develops readily, especially when fat-forming substances, such as fats or carbohydrates, are taken, together with a sufficient quantity of albumins. When, on the contrary, the thyroid gland is overactive, emaciation occurs, and the same condition may be brought about by the administration of thyroid extract.

Alcohol, like a meat diet, also has a stimulating action upon the thyroid. Excessive use of alcohol can, in the same way as long-continued indulgence in a diet rich in meats, produce a change from the previous condition of overactivity to one of underactivity and degeneration of this very important gland, which exerts an influence upon all the life processes of our organisms. (See various chapters in my book on "Old Age Deferred.")

The marked importance of the rôle played by the thyroid in the human nutritive functions is due to the fact that in addition to its influence upon metabolism it also acts upon the poisons which are taken into the body with the food. According to Blum, it detoxicates products which are formed through the disintegration of albumin; the experiments of Kishi also support this view. For its action upon other poisons absorbed in part with the food and drink (as alcohol) I would refer the reader to my work mentioned above.

The other ductless glands, including the hypophysis, the adrenals, the sexual glands, exert similar detoxicating actions, and they, likewise, are variously influenced by different foods. Alcohol, for instance, acts upon the adrenals and the sexual

glands. After feeding upon meat, a change in the hypophysis has been observed in birds of prey (Forsyth). The influence of food upon the sexual glands and sexual activity will be taken up later.

CHAPTER II.

THE FUNDAMENTAL LAWS OF RATIONAL FEEDING.

1. *The Importance of the Various Foodstuffs, and the Quantities which Should be Used.*

IF man and beast are to live and thrive, they must take unto themselves the same substances as those of which they are composed. Here, as so often in the study of dietetics, we see the rule proven, that like consists of like, at least in so far as the fundamental constituents are concerned. I might say that man is what he eats, or that he eats that which he is. The most important basic substances of which man and beast are composed are nitrogen, carbohydrates, and fats, and it must be our chief concern to take in these, together with the two other important constituents, the drinking-water and the nutritive salts. The same is true of plants, for they are fully as much living creatures as animals and mankind; they live in accordance with physiological laws very similar to ours, and suffer, in a general way, from the same pathological processes. They have, however, an advantage in their mode of nourishment in the fact that they can acquire the greater part of their food without any help from the outside. Mother Nature gives to them the nitrogen from the air, which they take up with their roots, through the aid of bacteria; the carbohydrates they also obtain from the air with the help of the sun's rays; the nutritive salts they draw out from the earth through the assistance of the rain. In order, however, that the most useful of these plants which contain the greatest amount of nourishing substances, and which are best adapted for our food, should rightly flourish, we lend a hand, and give them, in accordance with the suggestion of the great Justus v. Liebig, nitrogen and nutrient salts in the form of fertilizing agents.

These, then, exert a powerful influence: the nitrogen greatly furthers the growth of the plants. Indeed, it acts in the same way upon man, and when we wish to activate the growth of children we must give them food containing plenty or, at all events, sufficient nitrogen.

It appears that nitrogen stands in such relation to growth that, as we have already made clear, a plentiful intake thereof acts upon those organs which influence the growth, viz., the thyroid and the sexual glands. Man keeps on growing until these organs are fully developed and ready for work, but then growth ceases.

All of the albumin which we have taken up to this time has been useful in promoting our growth. This is also the period in which we should not deal too sparingly with the albumin, since it is required for the formation of new tissues. When, however, the full sexual development has been attained, so generous a supply of albumin is no longer needed. Except in certain conditions the adult man cannot store up albumin. On the other hand, a plentiful intake of albumin greatly stimulates the metabolic processes, for, according to Rubner, albumin particularly enhances the oxidation processes; the expenditure of energy is also increased.

Albumin thus exerts a powerful action upon the fire that burns within us; for it is no doubt permissible to compare our bodies with a furnace, in which burns an everlasting fire like that upon the altar of the goddess Vesta, and when this fire is quenched it means death for us, just as it did for the vestal virgin who allowed the fire to die out upon the altar of the goddess. Without this continuous process of combustion life is impossible. And when a machine, as represented by our bodies, is constantly fired, it must work. In the coals which we lay upon the fire the burning power of the sun is stored up which millions of years ago streamed down perennially upon the vegetation, and the same is true of the carbohydrate

contents of the plants which we consume. The stored-up motive power is now transformed into work. The heat engendered in this furnace by the combustion of the food can be measured in units, which we designate as calories. By a calorie we mean the amount of heat needed to heat 1 liter of water 1° C. According to Rubner, the process of combustion yields with

1 gram of albumin	4.1 calories.
1 gram of carbohydrate	4.1 calories.
1 gram of fat	9.3 calories.

For his adequate nutrition a man requires, according to von Noorden, per kilo of body weight:—

30 to 34 calories, in repose.
34 to 40 calories, performing light work.
40 to 45 calories, performing moderate work.
45 to 60 calories, performing hard work.

Now, although, according to Rubner, the various foods containing the same number of calories have the same nutritive value, yet their action in our economy is such that an albuminous food cannot be replaced by the same amount of calories of carbohydrates. Upon albumin alone a man could live, providing he could digest, for a greater length of time, the enormous quantity of albumin necessary to cover the coloric demands of the system, but not upon carbohydrates and fats without any albumin, even when they are taken in large quantities. This has been demonstrated by the experiments of Munk, Rosenheim, and Laegerroos, who gave their experimental animals the enormous quantity of 89 to 110 calories per kilo of body weight, and, yet, could not keep them alive. Albumin is absolutely indispensable for our nourishment, as our most important fluids, blood, lymph, digestive fluids etc. contain large amounts of it. Even in the adult, compounds of this sort are lost during every hour and every minute of the life process in carrying out the varoius functions, and it is impossible to replace them in any other way than by the ingestion of albumin. This may be supplied in the form of albumin either

of vegetable or animal origin. The preference, however, should, in certain proportions, be accorded to the animal albumin, for reasons which we shall set forth later. It might here be mentioned, though, that the animal albumin is much more easily digested and assimilated in the form in which it occurs in meat, eggs, cheese, and milk than that contained in plants, which, owing to the presence of an indigestible woody covering, often resists the action of the digestive fluids. Very often the stomach and intestines have a difficult task to perform in supplying us with the same quantity of albumin from vegetable foods. For an adult, too great an amount of albumin is certainly not indicated, since it greatly increases the processes of metabolism. The growing individual is able to assimliate the albumin, but the adult can only do so in exceptional circumstances, such as starvation, sickness, loss of blood in women after pregnancy, etc. Otherwise, he can do nothing with it, and must burn it up, thus overloading his metabolism with the ensuing residue, and possibly injuring his most important detoxicating and secreting organs. Carbohydrats and fat can be stored up by adults, but, as has just been said, albumin, in general cannot. This would indicate the necessity of avoiding too great an amount of albuminous food, *i.e.*, more than is required in ordinary daily life. That nature has not intended us for such food is perhaps shown by the fact that woman's milk is comparatively poor in albumin. It contains only 2 per cent. of it, together with 6.4 per cent. of sugar and 4 per cent. of fat.

Only in work requiring a great expenditure of energy is a large amount of albumin necessary, a fact we shall dwell upon later at greater length.

Authors differ as to the quantity of albumin which we should take daily. It was Voit who taught, as the result of his famous metabolism experiments, that 118 grams of albumin were necessary in twenty-four hours. However, in 1887 Voit published the result of some observations upon the diet of a

vegetarian whose twenty-four-hour albumin ration amounted to but 52 grams, yet Voit failed to mention that these observations did not harmonize with his dictum in reference to the necessity of 118 grams of albumin. Then followed independently experiments by Hirschfeld, a second contribution by Voit, and one each by Kumagawa, Klemperer, and Peschel, all of which tended to show that one might considerably deviate from the figures of Voit. Unfortunately, however, these experiments extended only over a few days of time. The work of the aforementioned men was now followed by the experiments of Breisacher which were the first to prove conclusively that for a greater length of time, thirty-three days, the albumin ration could be materially reduced below the Voit figures without producing any deleterious effects upon the general nutrition. A number of years later Chittenden took up this subject and, upon numerous individuals, duplicated the experimental results achieved by Breisacher in his thirty-three days' experiment made upon himself. Chittenden found, in experimenting with a number of students in American universities, that they did well and remained perfectly healthy for several months with 45 grams and were able to achieve good results in athletic sports of various sorts. Notwithstanding these facts, I would not advise the use of such a minimal quantity of albumin, for these figures prove merely that these otherwise healthy young men, stimulated by enthusiasm, were well and able to work for a certain length of time with quite a limited amount of calorie-supplying material. They show also to what an extreme point the absence of albumin can be carried when necessity demands it, without at once causing illness. When, however, I look at the pictures of these young men in Chittenden's report, and see that, in the majority of instances, their ribs appear to stand out much too prominently, I cannot recommend such a method of diet as a rational one. From the English and American standpoint of beauty, to be sure, any tendency to fat is unesthetic and ugly,

and many consider it an evidence of unsound health; a thoroughbred race horse is thin and is able to run well—it is also healthy. But personally I prefer a little lard in animals and a little fat in man, for it forms a sort of "savings fund" for the body in times of need. What is a man subjected to such a "minimum" of food intake to do when he falls ill, and has no fat to offer to a devastating fever, while at the same time he is not able to take any nourishment? When a State has in its coffers only that amount of money which is barely sufficient to meet the current expenses, it will soon become bankrupt; for our bodies such a long-continued deficit in *régime* also means certain bankruptcy, an eventuality which we must try to forestall by all the means at our disposal. The figures of Voit and Chittenden may be regarded as the two extremes, and, taking into consideration the influence of individual circumstances, the nervous system, the temperament, the climate, race, established habits, etc., it would be really impossible to specify any definite amount. It would be best to accept the figure intermediate between the two extremes—say, 75 grams—as an average ration of albumin. If Chittenden's men held out with so much less, it was because of training. Our tissues have a wonderful capacity for adaptation, which must be made good use of daily; otherwise, we would soon come to grief in the strife for our existence. The fact that the digestive fluids, as Pawlow has so beautifully demonstrated, are differently secreted according to the kinds of food we are taking is an example of this adaptability. I can, with training, manage with very little food; at first I would lose in weight, but this would soon cease. That it is possible to train one's self to go hungry has been shown by Succi and others, who at the same time remained quite well. Chittenden's subjects also at first lost all that they could bear in weight, but then the loss came to a standstill; when I see their photographs, however, I notice that they were by no means "fleshy." As I

have stated in my book on "Old Age Deferred," I found, in experimenting upon myself, that for two months I felt very well and did not lose in weight while taking 70 grams of albumin and 2300 calories per day. I drank a great deal of milk. When but little albumin is taken in with the food it is necessary to ingest all the more carbohydrates and fat.

Gelatin, a substance closely related to albumin, is nevertheless not a substitute for the latter. It serves as a "sparer," however, as do also the carbohydrates. It is obtained by the boiling of connective tissues or of cellulose.

The carbohydrates play an important part in our food as economizers of the albumin, and as such they are of much greater importance than the fats. The experiments of Pettenkofer and Voit, Fik, and Wislicenus have shown that the carbohydrates are the first in importance among the food substances for the furtherance of muscular work. We shall have more to say upon this subject in the chapter upon the increase of muscular force by specially adapted food. Fat, on the other hand, is of great importance in the formation of body heat. When it is very cold, much more fat is used up, as was shown by the labors of Voit and Duke Karl Theodor of Bavaria. With fatty food more combustion units are also introduced. We shall speak of the fats later. Both the carbohydrates and fats must be taken in larger quantities when the supply of albumin furnished is small, especially if extra work is to be performed and in a cold climate or in winter weather. The necessary quantity of albumin, carbohydrates, and fats per day for an adult is given by Rubner in the following figures:—

Body weight.		Albumin. Grams.	Fat. Grams.	Carbohydrate. Grams.	Calories.
50 kilograms	with light work	90	37	262	2102
70 "	" " "	123	46	327	2631
50 "	" heavy "	96	44	404	2472
70 "	" " "	118	56	500	3094

As we present in this work the tables of König, Rubner, Hutchison, Gautier, Balland, etc., setting forth the amounts of albumin, carbohydrates, and fats contained in the various foods, it will not be difficult to establish the approximate quantity of necessary food according to the figures of Rubner given above.

2. *The Nutritive Salts and Their Great Importance.*

It is a matter of common observance, how eagerly dogs will lick up blood. That this is not to be ascribed to the nutritive value of the albumin-content of the blood is shown by the fact that when they are given their choice of meat or blood they will at once turn to the blood. There must, then, be a difference in taste, and, indeed, blood is distinguished by its salty taste. When we accidentally scratch our gums with a toothpick, we can easily convince ourselves of this fact.

Dogs often do not get enough salt in their food, and, since animals cannot talk, they cannot ask for it when their masters forget to give it to them. The salt contained in meat is often not sufficient for their needs, and other articles of food frequently contain even less or, like vegetables,—for reasons which we shall give later,—have a tendency to increase their desire for salt. The iron contained in the blood may also instinctively attract the animal, as his usual food is mostly very poor in this constituent.

We can often observe how wild dogs get over bones. Here again there can be no question of great nutritive value, even when we include the marrow, for they very often prefer the bones to the meat. It would doubtless be more accurate to consider the other substances contained in the bone, and, of these, lime is the most important. Very likely it is also the instinctive desire for and need of lime which impels the dog to eat bones.

Possibly the marked craving of cats for fish is due to similar reasons, and is related to the large amount of phosphorus contained in the flesh and bones of many kinds of fish. Cats are also very fond of milk, and here it is perhaps the phosphate of lime found in considerable quantities in this food substance which forms the principal attraction, in addition to the other nutritive components.

Owing to its considerable content of these substances, a milk diet is of the greatest importance for young growing animals or children, since the bones must be built up, and these consist principally of lime and phosphorus. When these elements are not present in the food, or are insufficiently represented, growth is retarded, as has been shown by a number of experiments. The nutritive salts are necessary for both man and beast; we may even say that they are much more so than the food substances themselves, for without nourishment animals will live longer than when deprived of salts. Although the latter are not nourishing in themselves, the food ingested by us would be of no use whatever if it did not contain these salts, and when the quantity contained is insufficient marked disturbances of health occur. The special importance of these salts has been shown by the experiments of Forster, whose animals all died when placed upon a food from which the nutritive salts had been almost entirely removed. His experiments were confirmed by those performed by Lunin in the laboratories of Bunge. With the addition of sodium carbonate Lunin's mice lived somewhat longer, but all finally died. For man, animals, and plants to thrive, it is necessary that they should have a sufficient quantity of the nutritive salts. While many of these important salts may be present in quite ample amounts, the health will suffer if one of them—the iron, for instance—is not sufficiently represented. Liebig's law of the minimum amount is not only true in regard to plants, but of man as well, and we must see to it that precisely this element,

iron, which is present in such small quantities, be supplemented by that contained in the food. Probably there is no function of the body which could be carried on without an ample supply of nutritive salts. Without their assistance we could not build up our bones and tissues, nor would any cell nuclei be formed; the osmotic tension in the blood and in the tissues would be impossible without these salts, and very often the action of ferments, too, could not take place. They have a very powerful influence upon all metabolic processes, and without their help the unpoisoning of the organism from the products of metabolism would not occur. Since the iron is the carrier of the oxygen, the oxidative processes in our bodies depend upon the presence of the nutritive salts, and Albu and Neuberg class these salts as "catalyzers," *i.e.*, place them in the same category, as regards their mode of action, as the ferments and enzymes. Neither the nerves nor the muscles could carry on their functions without the presence of certain ions of sodium, calcium, and potassium, and without them life itself would be impossible, as has been proven by the experiments of Forster and Lunin.

Thus, these salts exist in certain quantities in the body; the earth-salts preponderate; others, such as iodine and arsenic, are present only in very small amounts, but nevertheless play an important rôle, and, as has been so rightly said, even the most minute quantities may cause a sudden acceleration in the chemical processes which take place in our bodies. I would like here to cite the example given by the secretions of the ductless glands, several of which, like the adrenals, are only tiny structures weighing a few grams. The secretion of these glands, which is also very slight in amount, circulates in all the blood and is everywhere active. From all that has been said, it is plain how necessary it is that we should ingest these important salts, and this we can do by a judicious choice of our food substances. Nevertheless, it is not such a simple matter,

for, in addition to the taking of the proper foods, it is also necessary that these nutritive salts should be absorbed, and, what is still more important, be assimilated, *i.e.*, retained. For when, as may occur with the lime-salts, the greater part passes out through the intestines in the presence of intestinal disturbances, we have but very little use of the salts, and we must see to it that the elimination takes place through the kidneys, rather than through the intestines. With some of the nutrient salts, *e.g.*, those containing phosphorus, the organic combinations may appear in the urine, while the inorganic are for the most part excreted by the intestine. Even when, however, the greater part of these salts is taken up by the blood, their assimilation depends upon the condition of those organs which regulate the general metabolic processes of the body. These organs are the ductless glands, and without their assistance we could derive no benefit from the nutritive salts which have been taken in with the food. The relations are here interchangeable. On the one hand, the ingested salts, including iodine compounds, have a very stimulating effect upon the thyroid, and the taking of too much iodine may even give rise to Basedow's disease; on the other hand, the thyroid has such an effect with regard to certain nutrient salts, such as lime, phosphorus, and common salt (sodium chloride), that its overactivity may cause an increased elimination of these salts. When one of these ductless glands is inactive, as, for instance, the spleen, the iron contained in our bodies, as found by Ascher, is not assimilated, but is thrown off in large quantities. In my opinion, there can be no doubt that the entire mineral metabolism is governed and regulated by the ductless glands. These glands also form a sort of depôt for certain salts; the thyroid, for instance, contains the most iodine, which it gives off as required; the spleen seems to act in the same way for iron, and the pancreas for silicic acid. The adrenals seem to stand in relation with sulphur. In view of the great importance

of this subject, it is very desirable that further experiments be made in this direction, for it is perhaps not too much to say that the entire future of the pathology of metabolism lies in this field. Upon such a basis the treatment of many diseases which are at present incurable, such as mental affections, could be greatly advanced, for reasons which we shall refer to later. With this object in view the investigation of phosphorus metabolism would be of primary importance. Probably none of the nutritive salts are of such special importance as those containing phosphorus, for the organ to which we owe our superiority to all other living organisms upon this earth, the brain, is much more closely related, in its construction and activity, to phosphorus and perhaps lime than to any other nutritive salt constituent.

There remains for us to state here the rules according to which we can in a rational manner regulate the intake of nutriment for our bodies. In general, we must establish this intake according to the relative amounts in which the salts are present in the various organs of the body. Lime, phosphorus, and common salt probably preponderate,—lime and phosphorus in the bones, phosphorus and some lime in many of the tissues, and salt in the tissues and fluids. Sufficient amounts of these substances must accordingly be absorbed, at least 1 to 1½ grams daily, and sometimes even more. Salt is the one which is principally taken,—usually much more of it than is necessary, which then has an injurious action. Other substances which occur only in small quantities in the body, such as iron, iodine, should only be taken in small amounts. When too much of these—iron, for instance—is introduced, a similar result occurs; as when plants are too much fertilized with only one salt they do not thrive. Those substances which exist in such minimum quantities in the body, like iodine, can, however, not possibly be introduced in too great quantities in our food. We must, furthermore, be guided by the amount given

off and the quantity required. A woman who is pregnant or is nursing requires more of certain nutritive salts, and we can observe how certain animals try in every possible way to obtain them, like the hen for instance, when she requires lime for the formation of the eggshell. If it is not given her in her food, she will pick it off from the wall. When we wish to know how much and which kind of nutritive salt is required for the culture of a plant, we examine the ground in which the plant grows, as to its salt contents, and then decide upon those needed; in man, the feces and urine should be analyzed, with a view to determining upon the salts to be introduced in the food. To carry on such metabolic examinations in general would hardly be practicable, but it is indicated in pathological cases, and I probably am not going too far in emphasizing the great similarity between the physiology and pathology of plant and animal life. It is certain that a growing organism requires a much greater amount of phosphorus and lime, and, as is the case with plants, the taking of phosphorus, lecithin, will, in man, increase the nitrogen supply and the growth. We must not conclude, however, that an adult organism does not require these salts; at all events it has been convincingly shown, by the experiments of Voit, Roloff, and of Baginsky, that in full-grown animals, dogs, pigs, etc., when lime and phosphorus are not present in their foods, the bones become thin and porous, and are only strengthened again by calcium phosphate. The introduction of the same is to be governed by the importance of the functions which are to be carried out by certain organs; and when these are greatly increased, the salts which are present in large quantities in these organs should likewise be introduced in correspondingly large amounts. In fatiguing brain and nerve actions, more phosphorus should be given and some lime, too, as will be shown later. In fact, a lessening of the phosphorus content exists in many pathological conditions of the brain (Marie), and by giving phosphorus it has been

possible, in certain cases in which it was tried, to bring about considerable improvement; Kocher and Trachewski showed the same results in Basedow's disease, by administering sodium phosphate.

In the treatment of epilepsy, similar results have also recently been obtained in the same way. It is, furthermore, of great importance to state that—as has been shown by experiments on animals and by clinical experience—when phosphorus is absent in the food polyneuritis and other conditions, such as beriberi and Barlow's disease, occur, which are greatly improved by foods rich in phosphorus. Phosphorus can best be administered in organic combination, as demonstrated by the experiments of Roehmann and his followers, and also in a most convincing manner by those carried out upon children by Cronheim and Müller.

A certain way of administering plenty of phosphorus is to give the nucleins. (See the works of O. Loewi.) In this way nitrogen and phosphorus are provided. The same result was obtained by Buchmann by giving lecithin, which also increases the growth of animals (Stocklasa). The lecithins are fat-like bodies, which contain much phosphorus; they are found in grains, especially wheat, oats, and other cereals. The pollen of flowers also contains considerable lecithin, so that there is a certain amount of it in honey. Among animal foods, eggs, in particular, have a considerable lecithin content. Furthermore, much of it is found in certain organs, especially in the liver; thus, when we eat calves' liver we are taking in a considerable amount of lecithin. The same is the case when brains and milk are used as foods. However, woman's milk is superior to cows' milk, as the body is better able to take up and make use of its phosphoric content.

To what extent the phosphorus of lecithin-containing foods is assimilated is shown by the fact that 80 per cent. of it is found in the urine and 20 per cent. in the stools, which proves

a most complete utilization. With a vegetable diet, there is a poor showing in regard to the assimilation of phosphorus; this is a great pity, since these foods often contain much of it; it passes off, however, together with the lime, through the intestines. In fact, in those living entirely upon a vegetable diet, much more phosphorus is found in the stools than in the urine, showing it has been very poorly made use of. It would therefore be very interesting to investigate whether the entire question of the condition of physical inferiority among vegetable-eaters, as compared with meat-eaters, which is noticeable even among birds, is not in some way related to these facts. Nevertheless, however much phosphorus we may be taking, even in the organic form, which is so much better absorbed and assimilated, its utilization in our bodies and its incorporation into the tissues for the maintenance of their functions depend greatly upon the condition of the thyroid and sexual glands, as well as the hypophysis. When the thyroid is overactive, much phosphorus is eliminated, as has been found by Roos and Scholz. On the other hand, as we have already mentioned, the elimination is lessened in underactivity of the thyroid. In order that phosphorus be properly assimilated, it is very important that the thyroid function be normal, *i.e.*, neither over- nor under- active. With overactivity of the sexual organs—the ovaries, for instance—there is associated an abundant elimination of phosphorus and lime; the same occurs in osteomalacia, in which psychoses also make their appearance. When, however, these persons are castrated, the pathological elimination ceases. Curatulo and Tarulli found that when female dogs were castrated the phosphoric elimination was diminished; after the administration of ovarian extract, it was increased again. Castration in women may likewise cure osteomalacia, and the excessive output of phosphorus ceases; the fact that the administration of phosphorus will also cure this condition is of great practical significance (M. Sternberg,

His, Sauerbruch). Phosphorus in addition influences the assimilation of lime; in osteomalacia it appears to do this in a roundabout way through the intermediary of the ovaries. In general, the nutritive salts, as we have already stated, act primarily upon the ductless glands, and the latter then regulate their use according to the various requirements of the organism. When phosphorus is administered the lime can also be better made use of, and we therefore see an improvement in this respect in rickets. This disease, which affects so many children, seems to be due to the absence of lime-salts in their food, as has been shown by the experiments of Roloff and Baginsky, as well as those of Aron and Seebauer. Seemann found, too, that the milk of the mothers of rachitic children is often surprisingly poor in lime; Göttig, again, proved that with food poor in lime the bony structure in the limbs suffers, and an increased reabsorption of the bones may occur. The absorption of a sufficient quantity of lime may also be interfered with by intestinal disturbances. Even when an ample amount of lime has been taken in with the food and has been absorbed, rickets may, in my opinion, still occur if there is degeneration of the ductless gland, the function of which is to utilize the lime which has been ingested in accordance with the requirements of the various organs. It is an uncontrovertible fact that ossification of the epiphyses of the hollow bones does not take place even for some time after the age of puberty, when the thyroid or sexual organs (as in eunuchs) are degenerated; and it is also well known that in degenerated conditions of the thyroid the formation of callus after fractures of the bones often does not occur. When, however, thyroid extract is administered, callus formation proceeds, *i.e.*, a better reaction on the part of the tissues becomes evident. In my opinion it must therefore logically follow that, however great be the amount of lime in the food, it will not be sufficient for the cure of rickets, unless treatment by thyroid extract is instituted at

the same time. Good results have thus been obtained in several cases; and if this fact has not been confirmed by others, it is because the other factor—a sufficient quantity of lime or phosphorus in the food—was not combined with the thyroid treatment. Both these factors, the nutritive salts and organotherapy, must be simultaneously brought into play. The fact that the thyroid gland influences the growth of bony structures, as was first shown by Lanz, undoubtedly affords a solid foundation for the above statements.

The amount of lime present also greatly affects the blood, for in the absence of lime coagulation does not take place, since its influence is that of an activator of the coagulating ferment. The coagulation of milk by rennet is prevented in the absence of lime. The influence of the latter upon the functions of the brain is also of great importance, since the experiments of Sabatani and Quest have shown[1] that an insufficiency of lime increases the irritability of the cerebral cortex, while an increase of lime lowers it. According to von Noorden, in rachitis, as well as in gout, administration of lime is very efficacious. Lehmann is of the opinion that lime increases the activity of the kidneys. From the above it will be seen how important it is to take plenty of lime in the food, which is best accomplished by the use of milk and drinking-water containing this substance. Although many plants are very rich in lime, it is unfortunately a fact that, as has been shown by Bunge, this lime is much less readily taken up by the blood than that contained in meat foods. As stated by Roese, it is a great drawback that, owing to the unskillful cooking of vegetables—it is more than unskilled; it is actually criminal—and especially through allowing them to stand for a long time in tepid water, a very considerable amount of the nutritive salts is lost; they are simply soaked out. Roese also pointed out the very injurious effects of drinking water poor in lime; he found that

[1] According to Albu and Neuberg, *loc. cit.*

wherever soft water is used many men are found incapable of the military service; the chest measurements, too, are smaller, and tuberculosis is very prevalent. If we consider the powerful influence exerted by lime upon the growth of the bony skeleton, this will be readily understood. We shall now present Bunge's table[1] of the amounts of lime and phosphorus contained in some of the commonly used foods:—

In 100 grams are contained

	Lime.	Phosphorus.
Cows' milk	1.510	1.86
Woman's milk	0.243	0.35
Yolk of eggs	0.380	1.90
Butter	0.411	0.80
Spinach	1.950	1.65
Figs	0.400	
Dates	0.108	
Plums	0.166	
Peas	0.137	0.99
Potatoes	0.100	0.69
Beef, only	0.029	
Graham bread	0.077	0.36
White bread	0.046	

In 100 grams of each of the following food substances, lecithin is contained, according to König, in the amounts specified:—

Peas	1.05	Barley	0.47
Lentils	1.70	Rye	0.57
Soja beans	1.64	Corn	0.25
Beans	0.81	Buckwheat	0.53
Wheat	0.43		

As we may notice, yolk of egg and spinach are very rich in phosphorus and lime; they also contain a large amount of the salts of iron. These are also most important salts, since iron forms part of the blood-corpuscles, and has to transport the oxygen which has been taken up in the lungs by the blood-corpuscles to the tissues. It thus acts as the oxygen carrier.

[1] Bunge: *Loc. cit.*, vol. ii, p. 88.

Furthermore, it plays an important rôle in the formation of hemoglobin, and in this connection Bunge is of the opinion that the iron in organic combination is more effective than in inorganic compounds. Bunge and Abderhalden have shown that animals receiving food poor in iron become very anemic; when they are given a diet rich in iron, *e.g.*, cabbage, carrots, and various greens, the iron-content in the blood is increased. As far as the absorption is concerned, there does not seem to be any material difference between the organic and the inorganic varieties; since, however, the former is absorbed more freely, it is a good plan to take in the necessary amount of iron with the food. If it is contained in sufficient quantities in the food, the inorganic preparations of iron may, when there is chlorosis or anemia, very powerfully excite the blood-forming organs. In fact it would seem, as I have already stated in my work, "Old Age Deferred," that the action of iron is explained by the fact that it primarily excites to greater activity the ductless glands which govern the blood-forming bone-marrow and also the thyroid and sexual glands. When, therefore, we wish to prevent or cure anemia, we should, instead of taking expensive medicaments and artificial preparations of iron, eat foods such as blood-pudding, spinach, eggs, etc. Bunge gives the iron content of certain foods as follows:—

In 100 grams are contained

Hogs' blood	0.226	Almonds	0.0025
Spinach	0.033 to 0.039	Lentils	0.0045
Asparagus	0.02	Strawberries	0.008 to 0.093
Yolk of eggs	0.001 to 0.024	Peas	0.062 to 0.066
Beef	0.017	Potatoes	0.064
Apples	0.013	Bilberries	0.0057
Red cherries	0.010	Grapes	0.0056

The observations of Ascher indicate that the condition of the spleen is of importance in the assimilation of iron in the body. He found that dogs from which the spleen had been removed eliminated more iron than healthy ones. The iron

set free in the process of metabolism can be stored up in the body through the agency of the spleen; otherwise it is eliminated.

Again, sodium chloride is an absolutely indispensable nutrient salt. Herbivorous animals possess a veritable mania for it, and it is advisable in a cow-stable, for instance, to hang up a large piece of salt if one is not to see the cows licking all manner of objects in search of it. Sheep also thrive and stand the bad weather better out in the fields if sufficient salt is given them in their food. The diet of these animals contains a large amount of potash salts; and Bunge has shown that when much potash is ingested in vegetable foods, much soda is withdrawn from the blood in consequence; this must then be made up again in the food. Thus, in eating potatoes, we require a great deal of common salt, since they contain much potash and very little soda; with rice, on the other hand, but little salt is needed, as rice contains but little potash salt. The passage of a large amount of salt is not at all good for the kidneys; they may be injured thereby. When the kidneys are diseased, very little salt is eliminated, as has been shown by Alexander von Koranyi, who introduced cryoscopy. H. Strauss, Vidal, and Achard have stated that the ingestion of much sodium chloride is very injurious, and may induce edema when the kidneys are already diseased; they found also that the edema was much improved when a diet very poor in salt was given.

H. Strauss found that when the kidneys do not quite fully carry out their functions sodium chloride is retained, whereas the other chlorides pass through. It follows from the above that an excess of salt may injure the kidneys, but that it has no injurious action when small quantities are taken daily, and when the kidneys are healthy. A rice diet would perhaps be the best for the kidneys, if the rice were not, as is often the case, overseasoned.

Besides the important nutritive salts already mentioned there are several others, such as those containing iodine and arsenic, which, though they occur in minimal quantities only, are of much importance in our bodies. Iodine plays a very great rôle because it is required by the principal ductless gland, the thyroid, for the carrying out of its functions. Iodine is absent from inactive thyroids, as also in the presence of connective-tissue goiters. The thyroid contains the most iodine, but the various other ductless glands, as well as the blood, also contain organically combined iodine; it is present, in particular, in the leucocytes. Iodine influences the various metabolic processes as a catalyzer. We take it in with our food. According to Bourcet, the vegetarian diet contains more iodine; certain varieties of fish, such as the herring, also contain it in quite considerable amounts. Aron states that the thyroid gland contains about 1 centigram of iodine. Arsenic, too, is contained in minute quantities in various organs, according to Gautier and Bertrand. In eating hens' eggs we absorb a small amount of arsenic. Silicic acid is also contained in our organs, and particularly in the muscle tendons. Schulz affirms that the connective tissue contains this substance in fairly large amount. It is an interesting fact that the iodine is contained in the thyroid, the iron in the spleen, whereas the silicic acid is especially well represented in the pancreas (Kall and Kunkel).

3. *Water.*

Like the plant, man cannot live without water. A plant may have at its disposal ever so much of the nutritive salts, without which it cannot live, but they are of no use to it unless it receives water, be this rainwater or dew, or that provided by the helping hand of man; water is absolutely required to bring these salts in solution, so that they may be absorbed by the roots. Man, likewise, would not be able to assimilate his food

without water, since it dissolves the nutritive substances, that they may be taken up by his body. The digestive fluids require a considerable amount of water, as does also the blood, of which it forms the most voluminous constituent. Through the aid of the water, the nutritive substances and salts which have been dissolved are carried from the blood into the tissues. For this a sufficient quantity of water must be at the disposal of the blood; if the blood receives too much of it, on the other hand, it will become too dilute. However, all-wise Nature has made provision for this eventuality—just as she has taken great care in the creation of man in general, much more than has been expended upon any machine devised and constructed by man himself—through the fact that this diluted condition is only a temporary one, soon disappearing. When too much water is withdrawn from the blood by copious diarrhea, as in cholera, or through excessive perspiration or a diet containing too little water, the blood may become thickened; Grawitz, however, has shown that this condition is also merely a temporary one; the inspissation soon passes off as a large amount of fluid is again taken up by the tissues.

While the absorption, then, of large quantities of water cannot cause any lasting effect, it is nevertheless not desirable to ingest too much of it, say, more than 1½ liters per day, since the tissues would then become too watery, and the task of the blood-vessels and heart be rendered too difficult through their being overloaded with so much fluid. In persons in whom the heart or the vessels are affected, as in heart disease or arteriosclerosis, this may bring about serious results, and consequently such persons should never take more fluid, soup and milk included, than 1 to 1½ liters daily. For these patients the best way of taking fluids is in the form of fruit and fresh green vegetables; in this way water is absorbed, albeit very gradually, so that there is no sudden overloading of the vessels and the heart is not taxed with too much work.

Grawitz, on the contrary, is of the opinion that large amounts of fluid do not have a lasting influence, either on the composition of the blood or that of the gastric juice. When much water is taken with the meals, the acidity of the gastric juice may be diminished for a short time, but it is soon restored to the normal condition, and, in regard to drinking while eating, I am personally of the opinion that it is a hygienic practice; a swallow of water, as Pawlow has shown, exerts a favorable influence upon the secretion of the "appetite juice," or psychic secretion of the gastric fluids, and many persons have no appetite for their food if they cannot at the same time take water or other fluids. I consider that even a little too much water taken with the meals is less injurious than the avoidance of it altogether. A great many women have the very bad habit of not drinking at all while eating, owing to a mistaken idea that this will keep them from growing stout. Now, water-drinking never causes the production of fat, as has been demonstrated by von Noorden. On the contrary, with the help of the water the nutritive substances are much better assimilated, while the appetite, as we have just said, is increased. Another great advantage is that the bowel functions may be assisted, and this, precisely, in women, who suffer from their wrong and avoidable habit of constipation, is greatly to be desired. When the contents of the intestines are well supplied with water, the forward movement of the feces is greatly facilitated. One of the very great advantages of drinking water is the fact that the end-products of the metabolic process are washed out, and this is more fully accomplished the more water is taken. While we thus consider the drinking of water as a very healthy practice, we must, on the other hand, not forget to mention that the drinking-water itself may sometimes be dangerous, even to life, when its origin is not unquestionable. The best drinking-water is furnished by mountain springs; it does not contain any germs. It is owing to this

that Vienna is much less affected than almost any other large city in the world by typhoid fever, which is so frequently caused by impure water. The water system of Vienna, which brings the water from afar, cost millions, but probably millions were never spent to better advantage, or have never borne better fruit. On the other hand, we very frequently meet this disease, which so often destroys young lives, in all cities which are supplied with river or fountain water. In addition to the purity of the drinking-water, its chemical properties are also most important. According to Roese's examinations, the health of a population is enormously influenced by the composition of its water supply. Not only does hard drinking-water have a most beneficial influence upon the teeth, but in cities where such water is drunk the chest measure and height of the people is greater, as well as their fitness for military service, while where the water is soft the opposite condition prevails. Moreover, the hard water has a more refreshing taste, which is quite an important advantage. In regions where the water does not have an agreeable taste, or is not free from impurities, the use of a not too highly mineralized water is advisable. The mineral waters containing some carbonic acid are more refreshing and also excite the appetite, especially in hot weather, when the mouth feels dry. Slightly mineralized waters are well fitted for daily use all the year round. This applies in a less degree, however, to those containing a considerable quantity of salts, which are really to be considered as medicinal waters, and are best used, for any length of time, in chronic diseased conditions.

4. *Hints Concerning Diet in Various Climates and During Different Seasons of the Year, and for Different Ages and Sexes.*

It is the firm opinion of the writer that man fares best when he follows the indications of Nature in everything, since

she gives proof in all her doings of a most wonderful perspicacity. This good management is well shown by the way in which, in every climate, she has caused to grow in abundance just the proper foods, and those best suited to the climate. We find the most juicy fruits in the hot southern countries, and, as a generous meat diet is not well borne in a hot climate, while such a diet, together with the heat, abolishes the desire for work, she has provided foods very rich in carbohydrates. In the tropical regions, in Brazil, Central Africa, Java, etc., such an abundance of plants grow which are replete with starch that only a portion of the excess would be sufficient to amply feed all the poor and hungry of Europe. I do not mean to say that uncivilized and necessarily vegetable-eating people dislike meat; on the contrary, and possibly because of the lack of albumin in their food, they have a perfect passion for meat. Consequently, they eat flesh used nowhere else as food. The South Sea Islanders, for instance, when visited by Cook, ate their dogs, which were fattened for the purpose, and in New Zealand the Maoris even now eat sharks, which are elsewhere considered to be unfit to eat. The desire of the Congo negroes for meat is also very great. The Commissary-general of the Congo State, Major de Meulemeester, told me that during an expedition his men, numbering 40, lived for two days and a half on the meat of an elephant weighing 5000 kilos or more, and they liked this food so much that they even sliced or scraped the skin into shavings, which they also ate. They even exchanged a large part of their regular rations for this skin, which they ate in preference! They consumed so much of this food that their abdomens projected noticeably. It is very probable that these people resort to cannibalism only because their albumin food is so limited. For both man and beast rarely indulge in barbarity when not driven to it by necessity, unless when cannibalism is practised for religious motives, as by the old Mexicans, the Aztecs, who tore out the hearts of

their sacrificed captives of war, held them up to the sun, and then cooked the flesh of their victims in order to devour it.

Meat foods are scarce in these tropical regions, as nature does not facilitate their creation. Cattle do not thrive in hot and dry climates as they do in the temperate zone and in the north. In these regions the most meat is eaten, and such a diet is better supported than in the hot south. There the plant kingdom offers in abundance the cereals which are rich in albumin and carbohydrates, and the greatest variety of grain. In the north, the grain which is richest in fat (oats) thrives the best. In the various animals and fishes of the north, like the whale, seals, and the mammals living in the cold waters, and also in certain kinds of birds, the fat-layers are greatly developed; which fact points to the necessity of a plentiful intake of fat in the food in these climates, the importance of which has been shown in the already-mentioned experiments of Voit, and of the Duke Karl Theodor of Bavaria. It is moreover a well-known fact that the inhabitants of the north instinctively take very large quantities of fat, as butter, for instance. In Sweden, much butter is used with the "Smörgås brod" at mealtimes, and I still remember that when traveling by rail in Dalekarlia, from Insjö to Leksand, during my student days, an old "Dalbonde" (Dalekarlian farmer) was continually taking butter from a large, copper, pan-like vessel, which he spread upon slices of bread until more than half of the contents were gone. He never stopped! The craving for something rich in calories, like whisky, for instance, in the damp, cold and wet, foggy climate of England is quite readily comprehended, even though, with the majority, the warming qualities seem to be the least important. While in the north fat is so greatly desired as a food, many cattle-raising tribes in Africa can find no other use for it than to smear their skins with it, as they also do with their oily seed-fruits.

On the other hand, the Eskimos take a large amount of

fat, blubber, and marrow; they fairly drink it. They like to eat the liver of the walrus, together with slices of its lard. Wrangel, in his Polar expedition, found that the Jakutes regarded fat of all varieties as a delicacy.

The above remarks also afford indications for our foods in summer and in winter. In the hot summer we must cut down the meat supply, but when much work is to be done a plentiful quantity of albumin must be taken, whether it be summer or winter, in the north or the south. Vegetables and fruit should form an important part of our diet in the summer, and when the heat diminishes the appetite it is advisable to take more spices or flavorings, in order to stimulate it. In winter this procedure should be avoided as much as possible, since the injurious substances contained in condiments cannot, to the same extent as during warm weather, be excreted with the perspiration, but must be eliminated by the kidneys. In the winter we can safely indulge in more meat and fat-containing foods. The acid fruits, on the contrary, are much less needed, and dried fruit such as raisins, dates, etc., should be given preference.

As far as the age is concerned, no meat should be given to little children, as their immunizing organs, which have the function of destroying the injurious disintegration products of meat, are not yet developed; the same is true for old persons, in whom these organs, the ductless glands, are already degenerated, and their immunizing power destroyed. Milk, with all its products, forms the best diet in these two periods of our lives, together with eggs, and carbohydrates in the form of gruel, rice, sago, tapioca, finely prepared grains, and certain cereals; also in porridges, although for the better development of the teeth in children foods of a harder consistency should also be given, as soon as they are able to masticate the same. Meat or other albumin-containing foods should not be spared during the period of growth, since otherwise, as we show in

various parts of this work, serious injury to the organism may result. As regards the quantity of the various food substances to be taken daily, Rubner has given the following table:—

	Albumin.	Fat.	Carbohydrates.	Calories.
In nursing children at the earliest age	8	17	37	344
Children weighing 20 kilos	63	37	225	1524
" " 40 "	80	47	280	1913
Old, weak persons of both sexes	91	45	322	2111

Regarding the difference in food for adult women and men, it would appear that women can do with less than men. It may be mentioned that women of the same height as men weigh less, and in general also do less work. However, after a series of observations I must conclude that most probably other features, principally sexual, should be taken into consideration; I have frequently noticed that hard-working women, masseuses, for instance, of the same weight, do well with foods which in albumin and number of calories are far below the rations of men doing the same work, and do not suffer at all in either their weight or health.

5. *Several Observations Concerning Cooking, Especially that of Fish and Vegetables.*

Were we able to take our foods in the form in which they have been created by nature, with all their useful components, and the important ferments contained therein, it would really form a complete diet from which we could derive much benefit. Our jaws and organs, however, are not so constituted as to be able to bear such a diet, unless we should, like the fruit-eaters, live upon fruit alone. While such a mode of nourishment might, for certain individuals, prove sufficient for a time, and undoubtedly beneficial as well, it is certainly not indicated for

the majority. We must take all kinds of foods, and in order that the nutrient substances contained therein be exposed to the action of our digestive fluids the one method now known that enables us to attain this end is cooking. In this way the raw fibers and connective tissues which offer such resistance to our teeth and digestive fluids are softened, and the very useful cells contained in them are rendered useful. On the other hand, some valuable substances are unfortunately lost, which is all the more to be regretted since the phenomenal carelessness and the lack of knowledge with which our foods are prepared are responsible for this unnecessary destruction and waste of many of the most useful substances. The greatest crime, however, is against that very important requirement of our food, its palatability. It is quite natural that in order to make them more digestible food should be heated to the boiling point, or even above it, but that it should be necessary to continuously, *i.e.,* during a prolonged period, subject them to the highest boiling heat during their preparation I am very much inclined to doubt. It is very certain that by such overcooking at a high temperature, which is unfortunately the custom in many places, and, as is sometimes the case, by overpressure, the foods are very much deteriorated, especially as regards the taste; their more material uses, namely, their nutritive values, also suffer. Very important constituents—and money value as well—are thus simply and unnecessarily thrown out of the window, since the purchase of a proper cooking utensil would obviate all this. Anyone who, in the public schools, has learned the most elementary principles of physics knows that water is a solvent, having the property of drawing out substances, and that hot water has an even greater action in this respect. Our cooks, however, do not in the least appear to take into consideration this first principle of their art, for meat, potatoes (even without the skin), etc., are left lying in water for some time before they are even placed upon the fire

to then be successfully freed, by slow boiling, of their most succulent properties. Certainly, such a great heat continuing for some time will greatly impair their quality and also affect their value as food; the unfortunate feature of it all is the fact that it is not at all necessary, for, once the "cooking heat" has been reached, the hard substances are softened, the injurious constituents are destroyed, and the foodstuffs need then no longer be continuously subjected to such a high temperature. Very many foods taste better, and are so in every respect, when after a short period of high temperature they are kept for a long time (one to two hours) at a much lower one than that of the boiling point.

How injurious this long boiling with overpressure may be has been shown by Axel Holst in experiments upon chickens. When they were fed with meat cooked for one-half hour at the boiling point (100° C.) they remained well, but at 110° C., with one-half hour's cooking, they were affected with neuritis. Boiling for any length of time is particularly injurious. All foods suffer under this procedure, but fish and vegetables especially so. They are all soaked out and lose all taste, which is particularly bad in the case of fish, which at best contains only a very small percentage of tasty substances. Steaming would be much the best for both fish and vegetables; the latter lose much of the substances which make them such valuable foods, namely, the important nutrient salts, as was found by Roese,[1] after cooking in hot water. The water in which vegetables are boiled is usually thrown away. It would be much more practical to let them simmer in a little water (several spoonfuls) and then to let them steam in their own juices, or, better still, by adding some butter in the so-called English style. Unfortunately, this method is not used in England, at least, not according to my experience. The vegetables which I ate everywhere in England were absolutely boiled out in hot water, and

[1] Roese: *Loc. cit.*

had no taste whatever. The same was the case in the country where the best vegetables are to be had, viz., Holland. It would consequently be far better to cook fish and vegetables, and all foods, in fact, in steam instead of in water; the very best method, however, is the cooking in closed vessels, with a water-containing receptacle below; in this way the food does not come into contact with either water or steam, the aroma is thus retained, the food has a much better taste, meat becomes softer and more juicy, the food substances retain their color and shape, and all are much more appetizing. Even though, as was found at the International Food Congress by Carcassagne and Maurel, stewing in butter causes considerable less loss of the nutrient salts, cooking vegetables by steam is advantageous in that it insures the retention of the nitrogenous extractives as well as the carbohydrates and albumins.

The art of cooking is therefore of the greatest consequence for our nourishment, and consequently for our thriving both in sickness and in health. We see, thus, the importance of the rational method of cooking in the care of the sick. In recognition of this fact, H. Strauss, in Berlin, has established a course of cooking for physicians, which has been very well attended. Unfortunately, sufficient means are not always at hand for the employment of a number of well-informed persons necessary for the proper management of a large kitchen; the difficulty of properly educating the kitchen staff is also an obstacle. In both civil and military hospitals, however, these difficulties might be overcome in the following way: In England and in America the daughters of the upper classes very often devote themselves to nursing, and probably in no other country in the world does this field of work occupy the same standing as in those countries. In this country (Austria) the nuns and trained nurses form a very valuable *personnel,* but they are not found in the military hospitals, notwithstanding the fact that women are much more efficient nurses than men. Since

the new movement of women's suffrage claims for them the same rights as for men, the women might also be retained for this service, but they would then have to proclaim their allegiance to the service of their country in the same manner as the men; this could be carried out in the form of one year's service, one-half of which would be spent in the nursing department of the military hospitals, and the other half in the kitchens of barracks and other public establishments. This would not cost the State any more, if the daughters of the upper classes were obliged to defray their own expenses. The priceless benefits derived from the proper care of the men would more than counterbalance the expenses incurred in providing for those women who would have to be paid, when the much better health of the soldiers, the more rapid recovery of the patients, and the consequent shorter stay in the hospital are taken into consideration. I am perhaps rather in advance of the times in advocating this plan, but it will probably be realized at some future time. In times of war the usefulness and activity of such a well-nourished and well-cared-for army would be very great, and the health of the people in general would also be vastly better, if every wife not only of a rich man, but also of a working man, would have undergone a course of previous training, which would acquaint her with the practical value of foods, etc. It would be well, too, if two or three times each week an hour were devoted to cooking in every school for girls, with practical teaching in regard to the various foods. Proper cooking is the basis of all dietetic science. The most valuable nutrient substance is of no use to us when not properly prepared.

6. *Hints upon the Mode of Eating, and the Rational Division of Meals.*

When one sits down to a meal he should not be restricted or harassed in any way, for just as a singer will be unable to

sing well when not in the humor for doing so will our nutrition fail to progress satisfactorily when we are not well disposed for it. When a man eats he is satisfying a craving, that of hunger; and just as is the case in all other impulses, he must, when eating, devote his entire attention to it. In a measure, eating is a sort of religious procedure, upon which depends the health and progress of mankind.

This was well known to the ancients, and they invested the act of eating with a sort of sanctity, as was also the case in the accomplishment of the other impulses of life, pertaining to its origin and maintenance. Some religions require that their high priests shall eat alone, as does the Dalai Lama in Thibet, and the same custom is observed by some oriental potentates. I saw this myself when, several years ago, I was treating the Shah Muzaffer Eddin, who was served by his courtiers, but sat alone at table.

While eating, and thus accomplishing a function of nature, neither man nor beast should be disturbed. The most good-natured dog will growl when disturbed while eating, and he has reason to do so, for Pawlow has shown that when a dog is thus disturbed, or when his attention has simply been diverted, the process of digestion, both in the stomach and in the intestine, is disturbed, and it takes a little while to set it in order again. Much less should a person be disturbed, and it ought to be made a law that no master should ever disturb his employes during their mealtime, or require them to serve a customer, especially when taking into consideration their frugal meal and the rapidity with which it is consumed. A considerate person will not even disturb a cab-horse when he sees it devouring its meal at the cab-stand; he would rather step into another cab.

Rapid eating is very injurious. An animal cannot restrain itself, and I saw a fox-terrier, before his food had been placed on the ground, leap into the air to seize it, and commence

at once to devour it. He could not wait patiently until his food had been put down. Owing to their great eagerness and their appetite, animals secrete so much gastric juice that they are able to digest insufficiently masticated foods. Man, however, does not have the same gastric juice as the hog or dog, which would enable him to digest so easily; consequently, with him, much depends upon the proper chewing of the food.

We must therefore eat slowly, and, above all, sufficiently masticate the food. This causes more saliva to be secreted, and the digestion of the food, especially that of a very starchy nature, is greatly facilitated; the food substances are also divided into such small parts that the stomach and intestines have less work to perform. According to Horace Fletcher, the food should be masticated until it has no more taste. We owe to the works of Fletcher, van Summeren, and Harry Campbell our knowledge of the great importance of a thorough mastication of our food for our welfare and the maintenance of our health. We should only swallow that which can be dissolved in the mouth or can be finely masticated; all the rest had much better be removed from the mouth than swallowed.

It is a very unhygienic practice to swallow one's food as hot as it can be borne. One could learn much in this respect from the dog. This sensible animal will not touch food which is hot, even when he is hungry, but will wait until it has cooled. How often do we burn our tongues with hot soups, and the whitish color of the pharynx, fauces, etc., shows that one has frequently taken such hot foods. Hot drinks, too, have an injurious effect upon the stomach, as has been demonstrated by Boas. According to the experiments of Best and Cohnheim, however, this, as well as the drinking of ice-water, has but little disturbing effect upon healthy persons.

A very important rule in eating is to wait until one has an appetite. It happens very often, however, that when in consequence of professional duties or bodily exertions there is

no particular appetite it comes gradually after one has begun to eat, in accordance with the old French saying, *"l'appetit vient en mangeant."* Bouillon, or meat extract, taken with a piece of bread will bring about this result, or what is still more simple, and not in the least injurious for anyone, a glass of fresh, cold water. In order that the appetite should be aroused, it is desirable to have a sufficiently long interval between the meals. When the breakfast is very frugal and limited in quantity, as is, unfortunately, the custom in this region, consisting only of coffee and a roll, the midday meal should come about four hours later, not later than at 12 o'clock, and, six or seven hours later, according as the midday meal has been more or less plentiful, the evening meal should be taken. When, however, we consider that after the supper, which takes place, say, at 7 o'clock, and which, with us, is also not to say abundant, nothing further is taken until 7 or 8 o'clock the next morning, the stomach remaining empty during twelve or thirteen hours, the perversity of our habit of taking such a light breakfast appears in its true light. It would certainly be more to the purpose to eat more at breakfast, and all the more so since very frequently the greatest amount of work is done immediately after that meal. It is certainly the main object of our food to furnish fuel for our machine in its work, be it bodily or mental; to replace lost tissues, and to protect us against disease. To eat little and to work hard with an empty stomach—very often mental work is more difficult than the bodily—certainly does not conform to the main purpose of our diet, and in growing children, who are to build up new tissues, is certainly most dangerous. Even though children are sometimes given a slice of bread and butter between the meals, and adults, driven by hunger, indulge in rather objectionable alcoholic drinks and—in German countries—sausage, possibly no longer very fresh, this certainly does not afford any real help. And since in some cities the midday meal is taken at 1 o'clock,

and in Berlin even at half-past 1, the injurious effect of such a sparing, unhygienic breakfast becomes most evident. It is therefore most rational to imitate the habit of the English and Americans, and to eat a better breakfast—not meat, however, but oatmeal porridge and an egg, or, in the case of fatiguing work, two, with pancakes made of cereals, butter, and syrup or fruit jam. In general, it is an important rule, in regard to our diet, to regulate the amount of food which we take at meals according to the work we are to do. It is also much better to take our principal meal, as is frequently done in France, Holland, England, and America, after the work has been accomplished and not before it, especially in the case of a mixed diet, with meat, since after a considerable proportion of meat has been eaten one is apt to feel rather heavy and uninclined to work. In regard to moving about after meals, the English saying, "After dinner sit awhile, after supper walk a mile," should be obeyed.

Before breakfast one should take 1 or 2 oranges or a half or the whole of a grapefruit (see Chapter IV); when available cherries may also be taken, or honey or fruit jams. For the principal meal, vegetable soup, meat, or an omelet; scrambled eggs, or eggs prepared with vegetables; potatoes or some other food rich in starch; some green vegetables; stewed fruit, fresh in summer or dried in winter. For the evening meal, or—when the principal meal is taken in the evening—at noontime, vegetable soup, eggs prepared in various ways, cheese, starchy foods, vegetables, stewed or fresh fruit. At the midday and evening meals, particularly with the milk-egg-vegetable diet, plenty of the former should be taken. The evening meal should not be taken later than 6 or half-past, or 7 at latest, and in any case at least three hours before going to bed. Those who wish to enjoy the advantages of very early rising, at 4 or 5 o'clock, to which I have referred in my book on "Old Age Deferred," should not take their principal meal later than at

11 o'clock. We would enjoy much more of the daylight in summer if we would adopt this beneficial habit. This, however, could only be properly carried out provided all factors would conform to it, as in Carlsbad, where the theaters and concerts are over at 9 o'clock, and one goes to bed at 10 or half-past. How many hours we could then work! I know, by personal experience, that from 4 to 8 o'clock in the morning a great deal of work can be done, the mind being then fresh and unwearied.

CHAPTER III.

INJURIOUS MODES OF FEEDING.

1. *The Injurious Effect of a One-sided Diet.*

The celebrated English physician, Harvey, who lived in the seventeenth century, treated one of his patients, suffering from obesity, by a diet consisting almost exclusively of meat, that is to say, albumin. As a result of this, the patient became much thinner. It should be mentioned, however, that such a diet, which since then has often been resorted to in obesity, causes a series of unpleasant symptoms in addition to the decided loss of flesh, to wit, fatigue, faintness, perspiration, nervous excitability, etc.

Such a one-sided meat diet always brings about a result which in every rational diet is to be carefully avoided, namely, a diminution of the amount of albumin in the body. Such a pronounced loss of bodily albumin may often have very serious consequences. These generally occur, as experiments have shown, when man or animals are restricted to an albumin-containing food to the exclusion of both carbohydrates and fats. Even when large quantities of albumin are administered there will be a very considerable loss of albumin, and when dogs are fed upon such a diet it is not possible to keep up their nitrogen balance. This occurs also when fats have been excluded from the nourishment. It is only by administering carbohydrates that this is possible. When these are absent there will be a considerable loss of flesh. In diabetic patients, after such a faulty, exclusively meat and fat diet, there will be a decided aggravation of the condition, together with the formation of acetone bodies, and very frequently such patients

die in coma, owing to acid poisoning. When, however, carbohydrates are added to the diet, a great improvement will often be noticed.

An almost exclusive carbohydrate diet, that is to say, a starchy diet, may also give rise to bad results. When starch is taken in too large quantities, acid fermentation takes place in the intestinal canal and intestinal peristalsis is greatly increased. In consequence the food is very soon excreted from the intestine without having been absorbed in the fluids of the body, and emaciation will result. Persons who nourish themselves almost exclusively upon carbohydrates, as rice, for instance, like the poor Hindoos, are, as a rule, very thin. With Europeans, too, who advocate a purely vegetable diet, the same thing will be observed. Since in this way too little albumin is taken, and very often fat as well, this should also be considered a one-sided diet.

By a one-sided diet I mean one which is almost entirely or at least principally composed of one of the three main groups of foods, albumins, carbohydrates, or fats, and in which the other two are absent, or one absent and the other but slightly represented. In this sense the purely vegetable diet is certainly one-sided, for, although it may sometimes, though not very often, contain a fair percentage of carbohydrates, there is almost always much too little albumin. When the albumin is not sufficiently represented, more fat should be taken; this, however, is rarely done by vegetarians.

When anyone lives solely upon plant food, the assimilation of the food substances by means of the intestine is but poorly accomplished. Atwater, basing himself upon his numerous experiments, found that with a purely vegetable diet up to 28.26 per cent. of the nitrogenous substance of the food was eliminated unused. When a moderate amount of animal food was added assimilation was considerably improved, only 11.59 per cent. being lost. With a plentiful supply of animal food,

only 8.88 per cent. was lost. According to the experiments of Atwater, it is impossible to retain the nitrogen balance with vegetable foods only.

Although milk contains all three of the main nutrient groups in the proper proportions, we must, nevertheless, consider a diet consisting of milk alone as one-sided, since only one kind of food is taken. An adult person can get on very well with milk only during a certain time, say four to six weeks; but when persisted in, this mode of nourishment is quite as injurious as any other one-sided diet. Milk, when taken alone, is not fully assimilated; about 18 per cent. of the food is lost through faulty assimilation. As much as 4 quarts of milk would have to be taken daily to thrive upon this diet. When cheese or bread is added, the assimilation is much better. The diet is then no longer one-sided, and has no injurious results; on the contrary, persons who are heroic enough to live in this way, or who are compelled by circumstances to do so, may be sure of a long life. As I have stated in my book on "Old Age Deferred," it has happened that such persons have lived to be over 100 years old.

A one-sided diet, consisting of the same thing day after day, may also be poorly assimilated for the simple reason that the sameness of the diet does not in the least excite the appetite, and that, as a result, the psychic gastric juice as well as the juices of the pancreatic glands are excreted in very small quantities, thus causing the digestive process to suffer. It is only in certain diseases that such a one-sided diet may be of use, as, for instance, in diabetes; even here it will be found that the addition of other vegetables to a diet of potatoes or oats will cause the sugar to diminish.

For a normal person a one-sided diet is not in any way advisable, as it has the same effect as insufficient nutrition, the injurious effects of which will be dealt with in the next chapter.

2. *The Consequences of Harmful and Insufficient Diet.*

It is a well-known fact that house animals, as poultry, for instance, very readily become diseased when they are not sufficiently or properly fed. In animals living in the open the same thing is often observed. The hazel hen, or heath pout, for instance, is greatly endangered by certain small organisms, the *Trichostrongylus gracilis*. It was noticed that, in the years during which they found plenty of food, they were much more free from these pests, and their number in the hunting season was much greater than at times when their food was scarce.

The same thing will be noticed in man. In times of famine epidemics followed as a rule, as we have seen in history. This is also true of the individual. The poor, who are not able to nourish themselves sufficiently, are much more apt to become the prey of a scourage, like tuberculosis, for instance, than the well-fed people of the upper classes. What a difference between the pale and thin tailor's apprentice and the robust butcher-boy, and how the pale cheeks of the poor little sewing-girl contrast with the rosy ones of the girl in the meat and sausage shops!

How much better it would be for the working population —I mean that of the large cities—to live in the country and till the ground! The food of the former is often much poorer and insufficient for the work they have to do. Their nutrition is inadequate. Meat is so dear at present that they can seldom buy any, and milk and cheese are also expensive and are but poorly represented in their diet. They are consequently restricted to the cereals as a general thing. In the latter, nourishing constituents are inclosed in thick husks, which are digested with difficulty, so that, as in rye bread, as much as 40 per cent. of the so important albumin is sometimes lost. It is evident, therefore, that such mode of feeding is often insufficient, and predisposes to malnutrition.

By malnutrition we mean the inadequate intake of nutrient values in the body. Such a faulty manner of feeding is especially injurious when an insufficient quantity of albumin is absorbed. Albumin is particularly necessary during the period of growth, since the building-stones for the elaboration of the bodily structure are mainly formed by an albuminous diet. For the adult as well a sufficient intake of albumin is necessary, especially when, owing to debilitating diseases, body substances have been lost which can only be replaced by an albuminous diet. Also in the normal person many cells are lost during the accomplishment of the various bodily functions, *i.e.*, the digestion, frequent coition, the daily shedding of the epithelium, etc.; and since all these cells must be renewed, the albumin diet must make up for the losses. When the laborer over and over again strikes his hammer upon the anvil, and continues to do this for a long time, he acquires a great muscular growth; the working muscles are better nourished owing to the continuous flow of blood into them, they increase in volume, and this muscular development can then only be successfully supported by the albumin. The labor itself is at the expense of the glycogen, and is thus carried on by the carbohydrates; the glycogen may, however, have its origin in the albumin, *i.e.*, in the carbohydrate molecules merged with it.

According to Pettenkoffer and Voit, more oxygen is consumed during hard labor and more carbonic acid is given off. The metabolic process is activated; and as a working machine requires more fuel than one which is standing still, so the laborer must also take more food.

In cold weather, also, more food is required. Voit and the Duke Karl Ludwig of Bavaria state that in the cold season more oxygen is absorbed and more carbonic acid given off. When the poor wear only thin clothing they give off much heat and are obliged to make up that much more. They thus require to be better nourished and must absorb more fat, since

more fat is consumed. It is related of the North Pole explorers that when they had eaten heartily they felt very comfortable in their sleeping bags, but when they had not much to eat they were shivering and freezing, no matter how well wrapped up they were.

When, therefore, a poor working man has but little to eat, and is besides thinly clad, he will almost always feel hungry while at work, and will readily fall a prey to infectious diseases. How much more is this the case among the children of the poor, who are in the growing stage, and have to do mental work at school, or, having reached the age of 14, and even before then in some States, are obliged to work in factories! How necessary it is to provide these poor school children with warm clothes in winter, and, above all, to give them meat, milk, and eggs, for it is principally among them that the disease of the poor (tuberculosis) finds the most victims! In order that the albumin intake be sufficient, at least 50 grams daily should be taken.

When children are given but a small amount of albumin a long time, the deficient nutrition involved may give rise to very serious results. Munk, Rosenheim, and Jaegerroos found that in dogs the food of which contained but little albumin the processes of digestion and assimilation were very poorly carried out. They lost fat to the extent of 28 per cent., and of the nitrogen twice or three times the normal amount. Jaegerroos's dogs very easily fell prey to infectious diseases and finally died. Intestinal putrefaction is also increased by underfeeding (Jaffé).

The injurious effect of underfeeding upon the formation and the composition of the blood is of the greatest importance. We have already mentioned that deficient nourishment has an injurious action in this connection; also that this is especially the case during great bodily exertion. We may also mention that Munk found a general increase of the water in the tissues

with insufficient nourishment. According to Grawitz, this is due to the diminution of the albumin content of the plasma. I also deem it important to quote word for word the statement of the hematologist, Grawitz.[1] He says: "I believe that I am justified in concluding, in accordance with the views of older authors, that insufficient and poorly combined foods lead to anemia, and this most particularly when heavy bodily labor is being carried on. This is first characterized by a diminution of the albumin content of the serum, but in the later stages there is undoubtedly an alteration of the red blood-corpuscles, since the full complete integrity of the cells would ultimately become impossible, in view of the hydremic condition of the serum."

According to Hoesslin's experiments on dogs, chronic undernutrition, when continued for months, caused a diminution of the quantity of blood in general. According to Munk, the quantity of blood in man is also diminished, and the muscles and organs are poorly supplied or underfed, thus developing bloodless muscles and lean individuals. Panner states that starvation caused a diminution of the blood content of the body.

All this may bring about most serious results, since our immunity against infectious diseases depends, as has been shown by Metchnikoff and others, upon the formation and composition of the blood, the elements of which protect us against the various bacteria. It is therefore easy to understand why chronically underfed persons easily become the prey of contagious diseases.

I would like to cite here, as an instructive example, the fact that races which feed principally upon vegetables and are poorly nourished have a comparatively short life. The Cameroon negroes, says Hans Meyer,[2] live on an average

[1] Grawitz: *Loc. cit.*, S. 246.

[2] Hans Meyer: "Das Deutsche Kolonialreich," Leipzig und Wien, 1910, S. 483.

about 40 years. Their food is mainly vegetable and consists of the starchy roots of various Euphorbiaceæ and Marantas, and of millet. (The assimilation of the latter, as has already been stated, is imperfect.) In contrast with these vegetarian Cameroon negroes is another African tribe, the Masai, of whom we have already spoken. They live upon a generous diet. The warriors feed only upon meat, blood, and milk; the rest of the people eat many vegetables, but also take a sufficient quantity of milk and meat. Captain Merker, in his comprehensive monograph concerning this tribe,[1] states the instructive facts that the Masais live to a comparatively old age, that sickness rarely occurs among them, and is rapidly cured.

It is obvious, therefore, that a plentiful, that is to say, a sufficiently ample, diet is a great protection for us. When we consider that we are constantly, by day and by night, subjected to the inroads of millions of bacteria, it is very foolish to facilitate their entrance into our tissues by insufficient nourishment. Especial care should be taken, therefore, that every one, according to his size and constitution, have the proper amount of food, and especially a sufficient quantity of albumin. Of all the various forms of bacteria to which our organism is vulnerable, the greatest danger of infection lies in the bacillus of tuberculosis, and against this a sufficiently generous diet, as we shall show in the next chapter, will best protect us.

3. *Tuberculosis as a Consequence of Deficient Nutrition, and its Prevention by Adequate Nourishment.*

It is a remarkable fact that the intelligent anthropoid apes which are exhibited in the various places of entertainment all die of tuberculosis, as do nearly all monkeys which are kept in Europe. It is rare that any of them die of any other disease.

[1] "Die Masai," *loc. cit.*, i, 243.

This strange fact has excited my interest since a long time, and several years ago, in London, I studied the monkeys in a circus, with a view to elucidating this particular matter. As a result I came to the conclusion that the principal reason was a faulty method of nutrition. The monkeys are originally vegetarians, and, bearing this in mind, their owners also feed them upon vegetables, principally carrots, fruits, etc. Such a mode of feeding would undoubtedly be sufficient in the tropical climates of the Congo or of Brazil, but is not in our northern climates. Here they require richer foods containing more albumin and fats, but, since such a diet costs more, the poor monkeys are deprived of it, and consequently fall an easy prey to tuberculosis.

I might add that the few monkeys which were given milk and meat were in much better condition, and did not contract tuberculosis. The circus chimpanzees of Hagenbeck, and Max and Moritz, which are now being exhibited in various places, are fed by their trainer, Mr. Castan, upon a mixed diet, and, as I lately had the opportunity to convince myself, are in very good health.

A necessary factor in the development of tuberculosis is the entrance of the tubercle bacilli into our bodies. We frequently inhale millions of bacilli—especially when we find ourselves in the very impure air of an overfilled Berlin café, or in a moving-picture theater heated by steam—and yet do not contract tuberculosis. Other factors must therefore be essential. An important one is the inherited tendency to the disease. We very often see that the children of tuberculous parents do, nevertheless, remain immune when they grow up under favorable conditions, are in the open air a great deal, and eat plenty of good food.

On the other hand, we observe that persons having no hereditary tendencies very easily acquire tuberculosis when they live in close rooms and are, in addition, poorly fed; as,

for instance, the sewing girls and dressmakers' assistants, etc. Of these two factors I would lay the greatest blame upon the deficient mode of nourishment. If the poor sewing girl could have the same food as her employer, the bad air of the work-room would affect her much less; since, however, her diet consists principally of cakes, sweets, and some few not very nutritious vegetables, and very rarely or perhaps never contains a sufficient amount of albumin (sausage or meat), the poor child becomes consumptive. That tuberculosis often occurs where there is plenty of fresh air, but where the food is inadequate, is shown by the fact that it is very prevalent among the Indians of North America. I had the opportunity, while traveling in the western portion of the United States, to visit an Indian settlement in the State of Arizona, and also one in the city of Quebec, in Canada. The inadequate composition of the diet and, more particularly, the habitual use of strong alcoholic drinks, by reason of which the food is poorly digested and assimilated, must here be held responsible. The Maoris of New Zealand are often victims of tuberculosis, no doubt primarily because they nourish themselves in a very poor and insufficient manner. They very rarely have any meat.

As an instructive example, contrasting with the above-mentioned people living in the open air, I would like to cite the inhabitants of London. The Londoners rarely acquire tuberculosis, notwithstanding the fact that they live in the foggy, smoky air of London, which is certainly not good, and where for several months they hardly see the sun. Why is this? It is because they eat meat three times a day, at breakfast, dinner, and supper, and the poor, at least twice a day. As Sir William Roberts has affirmed, no one takes as much nitrogenous food as the Londoner. I would, however, not be inclined to disregard the favorable influence of the drinking water, which in that city contains lime, while in New Zealand it is very poor in lime. Defective development of the thorax

and liability to the so-called "paralytic" type of chest and to tuberculosis are referable to this, although there are large cities in Europe where lime-water is drunk, and where tuberculosis frequently occurs, simply because the food of the poorer classes is miserable. Tuberculosis very often occurs among the inmates of prisons. Here the lack of air and exercise might receive the blame, but the food certainly exerts a great influence. In many prisons the diet is exclusively or at least principally vegetarian. When vegetables are eaten, as has already been stated, a considerable portion is not properly assimilated; we are therefore disposed to consider a vegetable diet one-sided and as tending to malnutrition, owing to the inadequate intake of albumin. The fare of the prisoners in the Plötzensee prison was studied through a number of years by Paul Jeserich and Meinert. It was mainly vegetable, and was not sufficiently assimilated. This non-assimilation was then remedied by the addition of meat and eggs. A strictly vegetarian diet, owing to its inadequate albumin content, causes anemia, and may frequently cause tuberculosis, particularly when adhered to during the time of puberty and the period of greatest growth. It may then be called an absolutely murderous diet, since it is more favorable to the development of consumption than any other one thing.

It is important to note that tuberculosis is more easily contracted when the largest amounts of nourishing substances are required by the body, in the growing period after the age of puberty, especially when there is excessive bodily development. It is a well-known fact that many giants die of consumption. Tuberculosis also occurs after pregnancy and other debilitating illnesses. In all these conditions much food should be taken, and particularly that of an albuminous nature.

We must now answer the question as to how this inadequate feeding, and in particular the deficient intake of albumin, gives rise to tuberculosis under these conditions?

This result occurs, in the first place, because, as we have already stated in the preceding chapter, such a mode of nourishment injuriously affects the quantity and the composition of the blood, upon which our resisting power against infection principally depends. The process of phagocytosis (Metchnikoff) by which the injurious bacteria are destroyed, the production of immunizing substances, the opsonins, etc., must correspondingly suffer. This, however, also depends upon the condition of the thyroid gland, as I have previously stated in my book, "Old Age Deferred," for when this fails the elaboration of these protective substances is hindered.

I have described in detail, in the above-named book, the action of the thyroid gland in protecting our bodies against infection of various kinds, as well as against poisoning. I shall, therefore, merely state here that, as I showed in a communication to the Tuberculosis Congress in Paris, 1905, this disease occurs most frequently in those conditions in which the thyroid gland is degenerated. In the conditions mentioned above as favoring the development of tuberculosis, there occur changes in the thyroid, associated perhaps with a state of exhaustion after a previous period of overactivity. The production of the protective substances is thereby lessened, and infection can take place the more readily. When, in consequence of defective nutrition with inadequate albumin content, the quantity of the substance contained in the blood which serves to build up the protective elements (the leucocytes, for example) which destroy the bacteria, and which are composed of albumin,—nuclein, nucleoalbumin,—is diminished, the resistance of the body will be correspondingly decreased.

Anything, therefore, which will increase the activity of the thyroid gland will likewise increase the powers of resistance against tuberculosis, and chief among these factors is a suitable food in sufficient amount. Meat is such a food; especially fresh, bloody meat, which contains a large amount of ex-

tractive substances. A diet of meat, and especially the extractive substances contained in the meat, exerts a stimulating effect upon the thyroid gland. One of the very best means for the prevention of consumption is the taking of finely chopped, raw, bloody meat, a method recommended since a number of years by a number of authors (Richet and others) and which is certainly very efficacious. The manner in which this protective agent acts has already been stated. The taking of many eggs and milk (raw, from healthy animals) may also prove very beneficial. Milk, as we have already stated, also excites the activity of the thyroid gland, owing to its content of the internal secretion of the thyroid, which passes into the milk. By means of a plentiful intake of fat in the form of cream, butter, bacon, and that contained in meat, as well as of carbohydrates, such as tapioca, sago, rice, macaroni, etc., a process of fattening-up will occur which will lessen the chances of tuberculous infection.

The best and most certain measure for the prevention of tuberculosis consists, then, in addition to other hygienic precautions,—plenty of fresh air,—of an ample diet, with plenty of meat, eggs, and milk. Overnutrition may, when long continued,—as we shall show in the succeeding chapters,—involve certain dangers; these, however, are by no means so marked as those of undernutrition, and, in any case, the former will prove a powerful weapon against tuberculosis.

4. *The Untoward Consequences of Overnutrition.*

When our food tastes good we are easily led to eat more than is necessary to satisfy our hunger, which is undoubtedly the chief object in eating. The enjoyment of our food is, however, an actual necessity, for when we enjoy what we eat we generally digest it much better than we would otherwise. It is apt to follow, however, that we eat too much, and that

this is injurious, especially in the case of meat, is shown by the distaste for work of any kind which comes over us after an unduly hearty meal. The lower the plane of intelligence of a man, the less, like the animals, will he be able to control his rapacity when good food is placed before him. Among many negro tribes in Central Africa meat is a rarity. Consequently their inordinate craving for this class of food may be due to the very low albumin content of their usual diet. When they are, at some time or other, placed in a position to eat meat, it can readily be seen what an injurious action is exerted by excessive amounts of this food. I have already mentioned that in an expedition made by the Commissary-general of the Congo army, De Meulemeester, his column of 40 men fed themselves during two and one-half days upon the meat and skin of an elephant weighing 5000 kilos. These negroes ate so much that their bellies stood out like balls. As a result of eating such quantities of meat the men became poisoned, as it were; they were stupefied and so tired that De Meulemeester was obliged, notwithstanding the haste with which the expedition was expected to advance, to rest for an entire day, until the men should recover and be able to resume the march. Overfeeding is always injurious, but this is particularly the case with meat, as illustrated by the example given. Not only negroes, but white men as well, will act in the manner just mentioned when they have partaken of too much meat. The dangers attending such a condition will be fully described in the chapter on meat diet. Other foods, however, than those which are really useful for us may also have a most harmful action when taken in too large amount. In the first place the organs of digestion are thereby subjected to an excess of work, and when, in addition, the food has been taken very rapidly, as is usually the case with heavy eaters, digestive disturbances will easily result, both in the stomach and intestines and the liver as well. In man somewhat the same thing occurs as in

geese when they are fattened: he is likely to acquire an enlarged and fatty liver, especially when, in addition to overeating, alcoholic beverages are taken as well. Cirrhosis of the liver is the result of such excesses. That the daily transportation of large amounts of blood, consequent upon too great an intake of food and drink, will finally prove harmful to the arteries is certain, since the elasticity of their walls is thereby lost and arteriosclerosis favored. This condition also frequently occurs when, together with heavy eating, including plenty of meat, there are other predisposing factors such as syphilis, tobacco, and alcohol.

The overloading of metabolism with the wastes resulting from the combustion of such quantities of food, especially of meat, can undoubtedly result only in harm, for even the organs which regulate the metabolic processes, the ductless glands,—thyroid, sexual glands, and adrenals,—become injured by such excessive feeding. Obesity, gout, and diabetes are the result. To the detoxicating organs, which are thus so seriously impaired, belong also the kidneys, and by such a faulty method of feeding a loss of important secretory portions of the kidneys is incurred and degeneration in their tissue takes place. Thus, we observe that a whole series of our most important organs is injured by overnutrition and, indeed, life is probably shortened. While malnutrition in early childhood is responsible for the many deaths caused by infectious diseases, the attainment of an advanced age is also often prevented by the pernicious habit of overeating. Galen justly said, at a time when many men fell by the sword: *"Plures gula quam gladius occidit"*—More are killed by gluttony than by the sword.

CHAPTER IV.

THE GOOD AND EVIL EFFECTS OF VARIOUS FOOD SUBSTANCES.

(*a*) Meat Diet.

1. *Concerning Meat and Various Kinds of Fish.*

There is no article of food which more closely resembles our tissues than the meat of animals, and probably hardly any from which greater amounts of albumin can be so easily absorbed and digested by our bodies. It is, however, not really because of its nutritive value that meat is so greatly sought after as a food, since quite a number of other food substances, such as rice, possess even greater nutritive qualities than meat; cheese and cereals in the form of porridge also contain large amounts of albumin. A major reason is no doubt the presence in meat of certain flavoring substances, which are very stimulating both for the digestion and general health; but the greatest value of meat probably lies in the fact that the quality of the albumin therein most nearly approaches that of our own tissues, and even more so, in that meat, especially certain kinds of it, is rich in cell nuclei, which play a rôle of considerable importance in carrying on the processes of life.

The cell nuclei, and the nuclein contained therein, have been the objects of much disparagement because the purin bases and uric acid are formed by their disintegration; but were we to abandon a useful article of food merely because it exerts an injurious effect when taken in excessive quantities, we would not only have to give up a whole series of valuable foods, but abandon the use of our most effective drugs as well. Undoubtedly meat has the disadvantage of carrying into the

organism more nuclein than perhaps any other article of food. It may be mentioned, in this connection, that these animal nucleins are supposed to have a more injurious action than those of vegetables, but we might also say that their value depends precisely upon the fact that they are animal nucleins. In certain kinds of meat, such as beef, we absorb more of such substances, as well as more of extractives and flavoring substances, because, by virtue of the greater proportion of connective tissue present, less of these constituents is given off in the process of cooking. It is different in the case of veal, which is more tender and of a finer fiber, contains less connective tissue, and consequently gives off its fluid contents more easily. We therefore call beef, which contains more blood, dark meat, in contradistinction to veal, which we call light meat. Veal contains much water, and its appearance fully justifies the term light meat. Chicken also includes a good deal of light meat.

Meat in general contains a large proportion of water,—that of the adult animal rather less than that of the young. Thus, the lean calf has from 78 to 80 per cent. of water in its tissues, while the ox has only 74 to 76 per cent. If the animals have been fattened, however, their meat contains less water. This high water content alone is sufficient to prove the fact that not much that is nourishing is left in meat.

The valuable constituent of the meat is the muscle fiber. This is not very readily attacked by the gastric juices, since it is surrounded by a covering layer of connective tissue and fat. In the process of cooking, the connective tissue is transformed into a gelatinous substance, and digestion is thus facilitated. In addition to the albumin the fat which is absorbed with meat is also a very important constituent, for the nutritive value of meat is enormously increased thereby; in taking fatty meats such as pork and goose meat, a large number of calories are introduced into the body. In the fol-

lowing table are shown the nutritive values of the various kinds of meat, as well as the percentages in which they are assimilated in the body. By the aid of this table we are enabled to distinguish the most valuable of the meat foods. Persons having a tendency to obesity should avoid those meats which contain the largest amounts of fat.

NUTRITIVE VALUE AND PERCENTAGE OF ASSIMILATION OF CERTAIN KINDS OF MEAT.[1]

Kinds of meat.	Nitrogen content. Per cent.	Fat content. Per cent.	Nitrogen assimilated. Per cent.	Fat assimilated. Per cent.	Calories contained in 1 kilo.
Beef, lean	20.50	2.80	19.99	2.66	1214
Veal, lean	20.00	1.00	19.50	0.95	1031
Lamb, fat	16.81	27.00	16.43	26.65	3130
Chicken, lean	19.72	1.32	19.23	1.27	1106
Chicken, fat	18.49	9.34	18.03	8.87	1744
Goose, fat	15.91	45.59	15.51	41.31	4778
Squab	22.44	1.00	21.59	0.95	1162
Pork, lean	20.10	6.30	19.60	5.91	1504
Pork, fat	14.50	37.30	.....	.....	4060
Rabbit, fat	20.47	9.76	20.93	9.17	1913
Hare	23.34	1.13	22.76	1.07	1207
Venison	19.80	1.90	19.40	1.40	990

NUTRITIVE SALTS CONTAINED IN CERTAIN MEATS, ACCORDING TO E. WOLFF.[2]

	Potash.	Soda.	Lime.	Magnesia.	Oxide of iron.	Phosphoric acid.	Sulphuric acid.	Silicic acid.	Chlorine.
Veal	34.40	7.96	1.99	1.45	0.24	48.13	......	0.81	6.47
Horseflesh	39.40	5.64	1.80	3.88	1.00	46.74	0.30	......	6.89
Beef	48.91	......	0.91	2.30	0.82	36.08	3.84	2.47	6.04
Pork	37.53	4.54	7.53	4.83	0.35	44.41	......	......	0.62

[1] After J. König, "Chemie der menschlichen Nahrungsmittel," ii, 1468.

[2] Cited by Albu and Neuberg, "Der Mineralstoffwechsel," p. 241.

As we may observe, the meat of the hare contains the most nitrogen, and consequently the largest amount of albumin. Usually, animals living wild show the greatest proportion of muscle tissue in their flesh, owing to their great muscular activity; they are also the least fat. While the pigeon has 22 per cent. of albumin, the fat, lazy goose has only about 5 per cent.; on the other hand, the well-fed bird has 44 per cent. of fat, while the pigeon has only 1 per cent. The goose, however, yields four and one-half times as much nourishment as the pigeon, though its meat has the great disadvantage of not being readily digested.

The digestibility of meat depends greatly upon the manner in which it is cooked. When the elastic fibers and connective tissue surrounding the most nutritive elements have been converted into a gelatinous substance by the cooking, the digestive fluids are better able to act upon them. When meat is suddenly subjected to a great heat, the albumin is coagulated. If it be placed in water which is boiling, very little of the taste-bearing substances and of the albumin are extracted. When roasted it becomes covered with a brownish crust, which prevents the escape of the juices; so that meat prepared in this way tastes very good.

Steaming, in which a gradual heating occurs, is also advantageous; here, again, very little of the extractive substances are lost, since it is mainly the steam and not the hot water which cooks the meat. This process of steaming is one which is worthy of being much more frequently used than has been the case. In broiling directly over the fire, all the tasty constituents are likewise retained, but it may happen that the open fire will not soften the inner portions of the meat, and that the connective tissue will not be cooked through, thus rendering the meat more indigestible. With the broiling of chicken, however, in which there is but little connective tissue, this objection cannot be made. The digestibility of meat may be

enhanced through its preparation in an inviting manner. If it is placed over the fire in cold water, and then cooked slowly, all the flavoring substances are extracted, and consequently but little digestive fluid is secreted, and the digestion is not well carried on. Raw meat is the most easily digested, but it must first have been well pounded, and then scraped or finely chopped. According to Jesser,[1] 100 grams of raw meat disappear from the stomach in two hours, when half-boiled in two and one-half hours, when well boiled in three hours; if meat is half-roasted, three hours are required for the digestion, and, if well roasted, four hours.

Meat, in general, is very readily digested, and is well assimilated. Rauhe, of the 2 kilograms of meat used in his experiments, decomposed 1080 grams, and, in the experiments of Rubner[2] with quantities considerably over 1 kilogram, only about 5 per cent. of the dry substance and less than 3 per cent. of the nitrogen were excreted with the feces.

In regard to the assimilation of certain meats, the experiments of Uffelmann showed that pork was the poorest in this respect (with about 6 per cent. loss of the albumin); next came old beef (about 5 per cent. loss), and the best was venison (only 2½ per cent. loss).

A certain influence in respect to the taste and ease of digestion of meat is exerted by allowing the latter to hang for a while, whereby, in very much the same manner as with vegetable foods, a kind of acid fermentation occurs in virtue of which the meat fibers become more tender, and are also softened by the small quantities of pepsin contained in the muscle tissue. If the meat hangs for too long a time, however, and is not kept at a very low temperature, putrefaction may set in, and, strange to say, most people love wild game the best, when it already has such a strong odor that it might be

[1] Jesser: Zeitschrift für Biologie, 1885, p. 129.

[2] Rubner: Archiv für Anat. und Physiologie, 1862, p. 311.

termed a stench. Americans of the wealthy classes prefer meat which has been kept hanging for a long time, and while I was staying in New York I was told that the guests of one of the very best hotels liked most to eat meat which had been hanging up for about six weeks.

In no other country is it customary to keep meat so long in cold storage as in America. The cattle is brought from the distant prairies to Chicago, is there slaughtered, and the meat afterward sent to all parts in special railroad cars with cold-storage chambers. In the cities where the meat is used it is also kept in cold storage. For fourteen days the meat keeps very well in this way, as far as the taste is concerned, as was found by Wiley, of the experimental laboratories of the United States Government. After that time it begins to lose its taste. Personally, I found that such meat tasted very good in the eastern part of the United States, while in Florida and in Texas, as well as in Los Angeles in California, it was very tasteless. By the time the meat had reached these places remote from Chicago, it had, after being kept on ice for a long time, lost all taste. Such meat is never juicy, and a great deal of butter must be used, in order to obtain a satisfactory amount of gravy. True, the meat which is transported—and afterward kept—in the cold-storage chambers does not taste at all badly, and that which is now sent from the Argentine Republic to Austria is said to be very good. It is quite different, however, with frozen meats. When meat lies upon the ice, all the taste-bearing elements are drawn out of it. In my travels in the far West of the Union, I often noticed how a negro waiter would take the meat from an icebox under the restaurant car, and it was certainly not surprising that such meat, which had already been kept for some time in cold storage, had absolutely no taste. In many parts of the United States and in Canada meat is kept frozen for some time, and while I was the guest of a family in Ottawa at Easter, 1907, we ate a caribou (a sort

of elk, which is found in Canada) which had been shot six months before. Two days later we ate a turkey which had been killed in October, and had been kept frozen since that time. The meat was quite yellow and dry, and absolutely tasteless. Such meat must be eaten immediately after it has been thawed out, for just as soon as it is kept in a higher temperature it putrefies; in the thawing process the ice particles burst the tissues and the bacteria find a ready entrance. The moisture which covers the meat when it thaws also contains a large quantity of the bacteria of decomposition. Meat can be kept frozen for thousands of years and still be used as food. Thus, the mammoths found in northern Siberia by the explorers often formed a welcome food for these travelers and their dogs.

In order that meat may be kept a long time, it is often salted, pickled, or smoked. Meat treated in this way is only satisfactory when no fresh or cold-storage meat is to be had. Smoked meat is sometimes better digested than ordinary meat, but the salted varieties, owing to their great salt content, are not to be recommended if the kidneys are in any way diseased. However, these meats are always to be preferred to the canned varieties, for very frequently antiseptic substances, which may prove injurious, are added to these, and usually, too, the meat of very lean animals is used for this purpose. The substances which are frequently added to meats to preserve their color and appearance include borax, boric acid, salicylic acid, etc. All these agents, even in minimal quantities, are injurious upon long-continued use, although after the use of certain of them in dogs no harmful results were noticed. The general health may gradually be unfavorably influenced when they are ingested over long periods, even though such effects do not at once follow after they have been taken either once or for some weeks. The majority of the diseases with which mankind is afflicted usually creep in through the accumulated effects of

successive slight irritations, by the operation of apparently insignificant factors which are just sufficient to take part in some chemical reaction.

A remarkable thing about this is the fact that these added chemical substances may be injurious to the organism, and, yet, have not the power to destroy the poisons of pathogenic bacteria; this is also the case with the other preserved varieties of meat, that is, the salted, pickled, and smoked kinds. They may, however, prevent putrefaction and unpleasant odors. It is here to be mentioned, as we have previously stated, that in persons in whom the gastric juice is normal the germs of decomposition in the meat will not work any noticeable injury, and it frequently happens that decayed meat is taken without causing any great harm. Count von Pappenheim, in his interesting work on Madagascar, states that he has seen Hovas dig out and eat the meat of an ox which had died some days before; the meat was already quite green in color, but it did not have any bad effect, as they were not in the least ill. The gypsies living in Hungary often eat decayed meat without its causing any injury. Finally, we must observe that if decayed meat were to cause harm or to make us ill at once very few of the people who are compelled by circumstances always to eat in restaurants, and to stop while traveling in hotels of a lower order, could live at all. To be sure, meat is carefully examined in the markets, but no jurisdiction controls the question as to how long the meat is kept in some of the smaller hotels (we do not, of course, presume to generalize) after it has been cooked for the first time. One person may not be in the least affected by it, the next may escape with an attack of diarrhea, but, more often than is suspected, such products may injure the fine epithelia of the kidneys and the liver. Moreover, there may sometimes be developed in the meat—usually in chopped meats and sausage—products of the decomposing action of certain bacteria, toxalbumins, which are very injurious, and

may prove fatal. While I was spending two weeks in St. Louis, four years ago, in the winter, several deaths occurred as the result of the eating of chickens which had been preserved for a long time; among others, a woman and her children died from this cause.

The bacteria of various diseases in animals often do not appear to cause any illness in man when the meat containing them is eaten. This is probably due to the cooking and the action of the hydrochloric acid in the stomach. Hutchison states that shepherds in Scotland ate for a long time the meat of sick sheep without being at all harmed, and Delcroix, of Paris, twenty-five years ago, gave to the poor the meat of sick animals, and even that of a dead dog,—the beneficiaries knew nothing concerning the origin of this food,—and no injurious results occurred. On the other hand, various authors report cases of fatal poisoning due to the meat of animals in which the spleen was diseased.

Many of the poisonous effects of meat may perhaps be ascribed to certain substances which the animals have eaten, such as poisonous herbs. It is an undisputed fact that the taste of meat is influenced by the food ingested by the animals. The best-tasting meat is that of cattle fed in the open. I have never seen finer meat than that sold in the butcher shops in Holland; this is because in that country, owing to the prevailing dampness, the grass grows most luxuriantly. In England and Denmark, too, very fine beef is raised. Cattle thrive best and furnish the finest meat in a temperate climate, as in the Argentine Republic and the northern portion of the United States. In the South the meat is less good. The cattle do much better, indeed, in the northern than in the southern part of Texas. In southern regions where it is very dry, as on the Riviera, in the south of Spain, in California, etc., equally fine beef cannot be had. The taste of meat is also improved by castration. Thus, a Styrian capon has a fine taste, as do

also the castrated chickens of Philadelphia. It is of the greatest importance that animals intended for our use should be carefully fed and bred. When animals are fed upon husks, beer-mash, etc., good meat cannot be expected. A chicken bought from a farmer has nothing much to commend it, but when it has been fed upon grain for one or two weeks, and in addition kept in so small a cage that the only movement it can make is to stretch out its neck to pick up its food, as is done in Belgium, it becomes very tasty, and is likewise very nourishing. In animals kept in the open air, especially sheep, the meat has a much more agreeable odor than is the case with those always housed up in stables.

In addition to the albumin and fat, meat also contains appreciable amounts of some very important nutritive salts; thus, 42.50 per cent. of phosphorus and 40.3 per cent. of potash are contained in the ashes. There is also quite an amount of iron, but, taking it all in all, meat is not a food which contains a large quantity of nutrient salts; it is greatly surpassed by vegetables in this respect.

Of the various meats, beef is that which is chiefly used. While opinions are about evenly divided as to whether beef or veal is the more easily digested, I am inclined to give the preference to veal. It is more tender than beef. Of course, it is necessary that the calf should be properly fed; when it is fed upon milk, the meat is very white and fine. With regard to the uric-acid-forming substances, veal probably contains rather more of the nucleins than beef; but when it is boiled, a greater proportion of the extractive substances passes out into the soup than is the case with beef. When veal is eaten roasted, especially the outer crusty portions, as in the roasted breast of veal, with the usual trimmings, it is likely to prove more injurious in regard to the uric-acid-forming properties than beef.

As a rule, for delicate persons and those suffering from various chronic affections, as well as for convalescents, veal is

to be recommended in preference to beef, and during the cure at Carlsbad veal and chicken form very important elements of the diet. Lamb is much more indigestible, solely on account of its especial kind of fat, which has a very high melting point; this peculiarity, as we have previously mentioned, affects the digestion very unfavorably. Lean lamb would be more readily digested, but it is not very easily obtained. When lamb is not fat, it can be recommended, and will be well digested. With us, lamb is not much eaten, but a great deal of it is consumed in England and France. In addition to beef and veal we eat a great deal of pork, but the greatest quantity of this meat is eaten by the Chinese. The hog thrives especially well in their country, and when Chinamen emigrate to Java they take their favorite animals along with them. Like the duck among birds and the eel among fish, the hog subsists upon a very unclean diet. The difference consists, however, in the fact that the hog cannot help itself, as it is given this food by its owner. If allowed to follow its own inclinations, the hog is a much cleaner animal than is generally believed, and likes to bathe itself, whenever this is possible. Moreover, be the food ever so unclean, it is in a very short time transformed by the hog's exceptionally efficacious gastric juice—probably the most powerful among all animals—into the animal's own palatable body substance. Certainly this much-decried beast is worthy of better care by its owners, and of much cleaner food. The meat tastes the best when the animal is fed upon corn. Recently hogs have also been fed upon meat, of which they can consume a considerable quantity per day, and also upon fish. The latter diet, however, has the disadvantage of imparting a rather oily taste to the pork; for this reason no fish should be fed to swine for at least four weeks before they are put to death. Pork is a very nutritious meat, but is, unfortunately, quite difficult to digest, owing to its high fat content. While the muscles of the pig are hard to digest, lying surrounded by

fat and connective tissue, the lard or bacon is more readily digested than many other kinds of fat. Bacon is a very useful adjunct in a diet which is poor in fat, and improves both the nutritive value and the taste of the food. In some countries it is customary, for the above reasons, always to add bacon to beans, peas, etc., as in America (pork and beans) and in France (*petits pois au lard*).

The most easily digested and the most highly prized food which we have from the hog—that animal which we only begin to like after it is dead—is ham. Many kinds of ham, such as those of Prague and of Westphalia, are world-renowned. Ham belongs to the class of most easily digested foods, and boiled Prague ham often forms an important part of the *régime* at Carlsbad. However, it is not well adapted for everyone; its great advantage is its digestibility, but otherwise it has all the disadvantages pertaining to meat in general. While it is readily digested, and likewise well assimilated in the intestine, much uric acid is formed from its decomposition products, and for this reason gouty patients should never take ham in the morning or evening, in addition to the meat allowed them at midday (which, indeed, it might also be far better for them to avoid). No matter how good the ham tastes, and how difficult it is for the physician, who would like to provide an agreeable diet for his patients, to forbid it, it cannot be allowed. Patients suffering from kidney disorders should not be allowed to eat ham on account of the quantity of salt which it contains (sometimes as much as 5 per cent., though in the Prague ham only about 2 per cent.). Almost every variety of meat should be eaten cooked, with but very few exceptions (as, for instance, scraped raw beef, from a healthy animal, in tuberculosis), but nowhere is this rule of greater importance than in the case of pork, owing to the danger of trichinosis. The trichinæ are very resistant, and withstand both the action of heat and the smoking process.

The meat of the chicken may probably be regarded as the most tender and most easily digested meat. The connective tissue is not present to the same extent as in beef, nor is there as much fat as in pork. The albumin contained in the breast meat of the chicken—the portion most to be recommended, though possibly not the most savory one—is fully exposed to the action of the gastric juices. This breast meat is the representative in the chicken of white meats in general, and, in order that it should contain plenty of the albumin, so necessary to convalescents for the reconstruction of their body tissues, the fowl should not be left to nourish itself upon worms, but should be fed upon grain, which is rich in nitrogen. Young, tender chickens are best digested, although they have not quite as much flavor; soup is best made from a full-grown fowl. The best tasting part of the chicken is the second joint, but only when the animal has been well fattened.

The turkey has some very excellent white meat. This bird had its origin in the United States (its long, curved beak somewhat resembles the nose of the Indians). In fact, it is also called "Indian" in some parts of Austria, especially in Croatia, where it is raised in large numbers. Its French name, *"Coq d'Inde,"* has been applied to it owing to the fact that, when, in the seventeenth century, the Jesuits brought this bird from America to raise it in France at their farm near Bourges, America was still called "The West Indies." There is no animal which is slaughtered in such numbers at all festive seasons in the United States as the turkey, and in particular just before "Thanksgiving Day" there is a veritable hecatomb of these fowls. Nowhere in the world, either, can such fine turkey be enjoyed while traveling as in the Pullman dining cars in the United States, where the negro cook prepares it in a particularly excellent way. In the West, unfortunately, it often does not taste as good, because it is less fresh and has been lying on the ice for a long time. The meat of the turkey

is more nourishing than that of chicken; it has about 2 per cent. more albumin and is much richer in fat than chicken.

The meat of the pheasant greatly resembles that of the turkey in nature and appearance. Next to that of the woodcock, it is probably the most delicious meat of all. It is fine and white, very rich in albumin, and easily digested; although, in the latter respect, chicken must take precedence over it. The very fine flavor of the pheasant's meat may be due to the fact that it lives in the open, in young forests and clearings. Owing to its free life in the open air, and because of the often aromatically flavored food which it finds in the meadows and woods, the pheasant's meat possesses a fine flavor and aroma. The meats of the partridge, heathcock, and wild duck also have an excellent taste. The meat of the young partridge especially is easily digested; that of the duck, on the other hand, is much less advantageous in this respect. In Holland very excellent wild-duck meat is to be had. Ducks seem to thrive especially well in Holland, where in the little city of Vollendam, which has only 3000 inhabitants, there are 800,000 ducks. The duck's meat is dark-colored; the muscle tissue is very compact, and consequently rather hard to digest. Duck is not to be recommended for feeble stomachs; the fat it contains tastes good, but does not increase the digestibility. By virtue of its content of albumin, that important nutritive substance, duck meat is, nevertheless, recommendable as a food substance, although we cannot precisely call it hygienic because of the frequently very unclean habits of the bird (which might be termed the hog of the feathered tribe), as also because of the inhuman way in which this fowl is often killed. While speaking of inhuman practices, we may as well take the opportunity to condemn as emphatically as possible the habit of the people of southern France, and many other southern countries, of eating small birds, and singing birds at that,—those little beings which charm us with their song, and besides make themselves

useful by eating the insects which are harmful to our growing vegetable-food products. What can be found so good in these tiny creatures which contain so little nutriment is incomprehensible to me. A larger bird, such as the pigeon, is much more nourishing, has a tender, easily digested meat, and is often eaten at health resorts, as with us in Carlsbad. It contains more albumin than the majority of the other commonly eaten birds; very much more than the chicken and the turkey, though rather less than the duck. It is the poorest in fat because, as we have already stated, being a rapid-flying bird, it makes much greater use of its muscles than do the other birds which we usually eat, and consequently does not lay on much fat. On the other hand, it contains the most sugar in the form of glycogen in its breast muscles, as shown by the researches of van't Hoff, as this substance is required for the mechanical work of flying. The pigeon, indeed, affords an instructive illustration of the manner in which the muscles gain in bulk and also in albumin content, as well as of the loss of fat in the arm of the laborer who handles heavy weights.

The greatest amount of fat, among all the birds, is to be found in the lazy goose. A very large amount of fat is often present under its skin, but only a limited quantity of muscle tissue. For this reason the goose, not only among birds, but among meats in general, contains almost the smallest quantity of albumin. Its nutritive value, therefore, depends upon its fat. Since, however, the fat surrounds the muscles, the albumin is digested with difficulty,—and all the more so because the muscle tissue belongs to the class of dark meats and the flesh has a very firm structure. A very useful portion of the goose's body is the liver; the Strasburg goose-liver patties are world-renowned. The ancient Egyptians, as has been stated by Wilkinson in his work describing their customs, were very fond of roast goose, which was never omitted from their festive meals, and it is possible that the preference of the Jews

for these birds dates back to the time of their stay in Egypt. On the whole, goose is a fit food only for excellent stomachs. In fact, the same may be said of game in general. Game generally furnishes a hard, tough meat, much tougher than beef, and to make it more tender it is generally hung up for a time, as is also done with the pheasant, which must be allowed to hang for about eight days, until the meat becomes soft; the meat of the hen-pheasant, in particular, gets quite tender and is easily digested. Since the same procedure is resorted to with game in general, as with the pheasant, it is called in France *"faisander."* The long period of hanging allows decomposition processes to be set up, acids are formed, and the meat fibers become softer and more readily digested. Meat treated in this way cannot, however, be considered a healthy food, for, while it may not cause any direct injury to the stomach, the decomposition products engendered are injurious to the intestines and, after their absorption in the body, to the organism in general. Although some persons may greatly relish such meat, and not notice any unpleasant after-result, with the exception, perhaps, of diarrhea, nevertheless, such a habit may be the starting point of some disease process. We must here again call attention to the fact that the results of certain disease-producing agencies are very often not felt at the start, but are only noticed when more fully developed, possibly already too late to permit of an absolute cure being attained. Care must be taken with game not to allow the blood of the animal to run out, as is the case with our domestic animals, in particular because these wild animals have often been chased and hounded before death, and are not in the same condition as those well rested immediately before slaughter. With hares it often happens, especially with us and in Germany, that the bladder is not promptly emptied, and consequently its contents impart an unpleasant taste to the meat; in Belgium and in France this matter is at once attended to by the hunter. Hare-

meat, particularly when the animal is still young, is truly a "tid-bit," and it is therefore not difficult to understand the eulogy of Martial:—

"Inter quadrupedes gloria prima lepus."

The meat of the hare, owing to its high albumin content, forms a very nutritive food, like that of the deer, which is also not difficult to digest when the animal is still young (not over 2 years). Probably the best-tasting meat among the four-footed game is that of the wild boar, as I have frequently had the opportunity to convince myself. Another easily digested meat is that of young rabbits, which are unfortunately sometimes replaced in large cities by cats,—though, while yet living, these two species of animals do not get on at all well together!

2. *Concerning Slaughter Wastes, Sausages, and the Value of Blood-pudding.*

Certain organs of the body are possessed of high nutritive value and characterized by their content of useful substances such as phosphorus and lecithin. The liver is an organ belonging to this class. Its tissues contain a large quantity of carbohydrates, while meat in general, with the exception of horsemeat, contains only minimal quantities of the carbohydrates. The liver contains much albumin and, in comparison with other meats, much carbohydrate and also much fat. There is a large amount of lecithin in the liver, especially in that of fattened animals, such as the goose; in this respect the Strasburg liver pie is a valuable article of food. According to the reports made, we must regard the liver as a valuable phosphorus-containing food. The liver of young animals is more easily digested than that of older ones, which contains considerable amounts of connective tissue difficult of digestion. In addition to the phosphorus in the liver, there is another

nutritive mineral, iron, which occurs in noteworthy quantities, especially in young animals.

The brain is another organ which is very rich in phosphorus, lecithin, and other similar substances. As a food substance it is characterized by a considerable content of fat, but it is nonetheless not hard to digest. It is well borne by the stomach, but, according to the experiments of Rubner, is only incompletely assimilated.

The kidneys have a very agreeable taste, especially lamb kidneys; these are not much used with us, but in England, more particularly, find much favor at the breakfast table. They are also nutritious, because they contain albumin and fat. Nevertheless, the kidneys, as well as liver and brain, have the disadvantage of being very rich in nucleins as well as in uric-acid-forming substances; the brain contains the least of these, the kidneys much more, while the kidneys and the pancreas (sweetbread) contain the most nuclein. The organ from which the greatest amount of uric acid is formed in the body is the pancreas (sweetbread) of the calf. According to my experiments, it has been shown that after these organs have been eaten by diabetics sugar will be very readily secreted or the amount previously excreted will be increased. Consequently patients suffering from gout or diabetes should not eat these organs.

The bones may serve for the preparation of soup, or for the manufacture of glue. Their most important constituent is the marrow. This is very rich in fat, and contains nearly as much as butter; it is also rich in nutritive salts. Since the marrow plays an important part in the formation of the blood, that taken from young animals might form a useful food in chlorotic conditions. With this end in view foods are also industrially compounded from this substance. The marrow is also rich in lecithin and phosphorus, which still further increases its value. It is, however, rather hard to digest, and

is therefore not indicated as a food along with the usual diet, nor should it be taken alone, in large quantities; it is rather intended to be used in connection with less nutritious substances and, more particularly, soup.

Sausage in general is also very rich in fat, and it is just this fat content, together with the albumin contained in it, which places it in the list of the most nourishing foods; owing to its fatty contents, however, it is not easily digested, and the strong flavoring with pepper, garlic, and paprica adds to the difficulty. After having eaten highly flavored sausage, it very often happens that eructations occur some hours later. Sausage is made of various refuse substances from the slaughter-houses, such as the lungs, liver, heart, etc., all of which are forced into the protecting skin, which is too thick for us to see through, so that we can never tell what is inside. How right was old Father Cats when he said of sausage:—

> "Wie Worste kouwt,
> en weduwe trouwt,
> die weet niet wat daar is ingedouwd."

(Literal translation: "He who eats sausage, and has faith in widows, does not know what they are hiding.") Although we do not fully agree with him in respect to the widows, as far as the sausage is concerned we never know what we have to deal with until, as Robert Hutchison so truly says, "we have eaten it up," and it is just for this reason that we consider sausage as an unhygienic food, and partially also because it contains such a considerable quantity of condiments. The fact that it is also frequently made from horse- and mule- meat would not, of itself, make it unhealthy, but the use of meat that is unfit, spoiled, and injurious does make it so. Sausage often contains very harmful poisons, which cause the much-dreaded cases of sausage poisoning. When the meat has been stuffed into the sausages it cannot well be inspected to find out whether it is fresh or otherwise. This might perhaps be detected by the

sense of smell were it not for the fact that any bad odor is pretty well disguised by various ingredients which have been added to the meat, and which are often injurious. It is necessary to be exceedingly careful when buying sausage. Only the very best quality should be used, if one does not wish to harm the stomach. The most useful among the various varieties of sausage is blood-pudding, for reasons which have already been given in my work on "Old Age Deferred."[1] I may merely say here that blood forms a very strengthening food substance, owing to the quantity of albumin it contains. According to König,[2] blood-pudding or sausage contains 11.81 per cent. nitrogenous matter in the original form, and pretty nearly the same amount of fat, together with 25 per cent. of extractive substance free from nitrogen; in the dry substance it contains 24 per cent. of nitrogenous material and 22 per cent. of fat. Blood is an important nutritive substance owing to its content in important nutritive salts, like iron; this is especially true of pigs' blood, from which blood-pudding is usually made. According to Bunge, it contains more iron than any other food substance; 100 grams of pigs' blood, he says, contain 226 mg. of iron. The quantity of lecithin in pigs' blood is also not inconsiderable; according to Abderhalden, 0.231 per cent. The content of protective substances in the blood is also important, as well as that of the secretions from the internal glands, the thyroid, adrenals, etc., which are carried into the blood. We might still add that fresh blood-pudding is not difficult to digest and is a healthful food; and since, as we have said, it contains organic secretions, it is an organotherapeutic curative agent. According to the investigations of Bessau and Schmidt, in regard to the purin contents of various foods, blood-pudding is characterized by the fact that no purin is contained therein,

[1] Chapter on "The Blood of Animals as an Iron-containing Food, and as an Organotherapeutic Remedy."

[2] König: i, S. 76.

and consequently it does not facilitate the formation of uric acid. The ingestion of blood-pudding is especially indicated in anemic, chlorotic girls and women, who would not need to buy manufactured preparations of iron when they can have in this food a most useful organic iron preparation which is nourishing as well. In Scandinavia some very inviting, good-tasting dishes are prepared from blood-pudding, with the addition of flour, barley, and raisins.

3. *Advantages and Disadvantages of Meat Extracts and Meat Soups.*

Various nations, like the Abyssinians, are accustomed to eat their meat raw. On certain days great festivals are held (Brunde) and very great quantities of raw meat are eaten. These people afterward are very much excited and as if intoxicated, as has been stated by Johnston, who has traveled through vast regions in southern Abyssinia. Dundas Thompson writes in the same way concerning an Indian tribe which usually eats vegetable food, but which at a festive meal ate, in his presence, much raw meat. About one or two hours later they seemed to be greatly intoxicated by the meat. We must conclude, from these observations, that the ingestion of large quantities of raw meat exerts a very stimulating action upon the nervous system. Druitt reports similar effects. He found that the use of a fluid extract which he prepared from raw meat had, after a short time, a very stimulating action upon the brain. These exciting effects may also be observed after the use of Liebig's meat extract.

Explorers, after traveling in regions where no meat was to be had, have often reported the very valuable services rendered by the use of such meat extracts in connection with their otherwise exclusively vegetable diet, and what an exhilarating effect it had upon them. As a matter of fact, the substances

obtained from the meat which are contained in such an extract are the same as those found in raw meat, which, as stated above, has such a stimulating action. The substances which produce this enlivening effect upon the nervous system are the potash salts and the meat bases. The exhilarating action is, to be sure, followed, as is usually the case with stimulants, by a depressed condition; but this only occurs, as in the case of the latter, when too much raw meat has been taken.

All these substances are eliminated from the meat, which contains a considerable amount of fluid, during the process of cooking; they are fairly washed out and the meat is absolutely soaked out, especially when it is put in cold water, and is then gradually heated and boiled. The fluid and soluble portions of the meat are extracted, but they have very little, if any, nourishing value. Of the albumin only a very small quantity is withdrawn, and this is then skimmed off, so that it is entirely lost. When ½ kilo of beef and 189 grams of veal bones are boiled, 543 c.c. of soup is obtained, as found by König, which contains 1.19 per cent. of albumin, 1.40 per cent. of fat, 1.83 per cent. of the other extractive substances, 0.152 per cent. of potash salts, and 0.089 per cent. of phosphoric acid. We thus see that potash salts and phosphoric acid are present in not inconsiderable quantities, in a soluble and easily absorbed form. According to König, 50 per cent. of the extractive substances and 80 per cent. of the nutritive salts are found in the soup. In the ash, König states, will be found 30 per cent. of phosphoric acid, 42 per cent. potash, 0.2 per cent. oxide of iron, and considerable common salt, about 9.63 per cent. The extractive substances are creatin, creatinin, xanthin, guanin, sarcin, etc., and also small quantities of urea, uric acid, etc. The quantity of these extractive substances and the taste of the soup and juice depend upon the quality of the meat, its origin, and the mode of death. The meat of full-grown

animals is the best for this purpose, and an old chicken will make a much better meat soup than a young one. Veal, on the other hand, owing to its tender fibers, will more readily give off its juices, as has been stated by Max Adler; consequently, veal purée and veal soup contain more extractive substances. It is most natural that the fresh raw meat of an animal raised in the fertile meadows of northern Texas or Nebraska, or in the pampas of the Argentine Republic, would give a much better juice than that of animals feeding on our poor meadows, although some of the European pastures, especially the Hungarian and Dutch, as well as the English, furnish a very good tasting and fine quality of meat. However, in no part of the world are such great numbers of exceptionally fine cattle raised as in the Argentine Republic. Here, meat is so plentiful that the Chaco Indians and the Gauchos feed almost exclusively upon it. While Sir Henry Head was, in the early part of the last century, riding across the unbounded pampas on horseback, for weeks at a time, he lived entirely on meat and water, and he affirmed[1] that he never in his life felt so fresh and well. Had Sir Henry adhered to this diet for a longer time, and had he not been most of the time in the saddle, and consequently getting plenty of exercise, he would probably, later on, not have escaped the gout, which so frequently occurs among the meat-eating people of his country.

It is, therefore, not a matter of surprise that Liebig conceived the idea of utilizing this great abundance of meat, which he believed to be a necessity, in view of the many people suffering from meat famine in many parts of Europe. He built factories and started the wholesale manufacture of the Liebig meat extract, which, he states, is obtained by the withdrawal of the juices from fresh meat which is chopped up, after having been freed from fat and tendons, and is then placed in hot water. The solution obtained is first filtered, and

[1] After Pavy.

afterward evaporated in large vats to the consistency of a thick syrup. He adds 8 to 10 times the quantity of water to the meat, which is boiled for half an hour. According to Liebig, 30 pounds of lean beef are required to make one pound of meat extract.

We shall now show the chemical composition of certain varieties of meat extract.

According to König,[1] Liebig's meat extract contains:—

17.70 per cent. water.
61.04 per cent. organic substances.
9.17 per cent. nitrogen—total.
0.36 per cent. insoluble and coagulable proteins.
6.01 per cent. albumoses.
0.59 per cent. ammonia.
59.08 per cent. various nitrogenous compounds.
21.46 per cent. nutritive salts.
8.98 per cent. potash.
7.75 per cent. phosphoric acid.
3.99 per cent. common salt.

According to Flehner,[2] certain meat extracts are composed as follows:—

	Water.	Fat.	Gelatin.	Albumin.	Meat fibers.	Albumose.	Peptone.	Meat bases.	Ash.
Liebig's extract.......	15.26	0.34	5.18	......	2.12	2.01	8.06	39.30	28.31
Armour's extract.......	15.97	0.21	3.31	......	......	1.75	5.13	41.12	29.36
Valentine's meat juice .	54.53	0.10	0.75	0.25	......	2.00	2.87	12.48	12.01
Bovril fluid meat juice .	28.34	1.07	4.56	5.37	......	8.38	3.18	19.38	17.67

When a certain quantity of water is added to these meat extracts, a good soup can be made. With one-quarter of a pound of Liebig's extract, it is said that as much bouillon can

[1] König: ii, S. 55.
[2] Flehner: Quoted after Duncan.

be made as could be obtained from 8 to 9 pounds of bones and fat-free beef.

Now, as to the value of meat soups and meat extracts, I would, in consequence of their stimulating action, be inclined to consider them, as the other stimulants, alcohol, etc., as a sort of medicine, and as such they have an excellent effect. They may be, as has often been suggested, mixed with and taken in tea, whereby the exciting and exhilarating effect is increased. Avicenna already recommended meat soups after great exertion, and in conditions of exhaustion in general Convalescents and invalids will be benefited by a cup of good bouillon, or by the addition of meat extract to an otherwise weak bouillon. They do not obtain nourishment from this, but are stimulated, and often feel somewhat stronger.

The resisting capacity of such weak persons against infections in general is thus increased, according to a series of experiments. Richet, in experimenting on dogs, found that raw meat was very efficacious as a preventive of infection by tuberculosis. This property is, on the other hand, entirely absent in the case of cooked meat, which no longer has any extractive substances, and from which soup cannot be made. Together with the juice of the meat, certain protective substances which are found in the blood are also extracted, as well as the products of the ductless glands, particularly the thyroid, which has an important immunizing action against all kinds of infections—a subject I have fully explained in my work on "Old Age Deferred." I have also shown (at the Tuberculosis Congress in Paris, 1905) that the thyroid plays an important rôle against contagion in tuberculosis. It is precisely this stimulating action of the juice of the raw meat upon the thyroid which probably causes the excitant effect upon the nerves, for, as we have already seen, the thyroid is one of the most important regulators of the nervous system, and a diseased condition of this gland always causes changes in this system.

Another effect produced by meat soups and meat extracts in general is a very powerful stimulation of the digestive functions, as has been shown through the researches of Pawlow. When there is a lack of appetite, probably no medicinal agent is more effective in stimulating it than a good cup of bouillon taken just before eating. A further action of the meat soups is the diuretic effect due to the meat extracts contained therein, which causes a rapid elimination of considerable quantities of urea. This no doubt stands in causal relation to the increase of blood-pressure induced by the meat extracts. These extracts undoubtedly exert an irritating action during their passage through the kidneys; hence, meat juices or soups also have an injurious action, and should only be given to persons with sound kidneys. Owing to the fact that they increase the blood-pressure, meat extracts and bouillon may exert a very prejudicial effect in cases of arteriosclerosis. For such persons, who usually already have a high blood-pressure, the use of meat bouillons is not indicated, as, otherwise, the process of arteriosclerosis may be favored. In consequence of its stimulating action upon the thyroid gland, the use of meat extracts when this organ is diseased may bring about most injurious effects, and should not be allowed; it is for this reason, too, that in advanced age, a state primarily to be ascribed to a degeneration of the thyroid gland, the use of meat extracts should be avoided. This is all the more necessary since the kidneys and liver have also undergone more or less degenerative alterations. In advanced age, a glass of milk should be preferred to a cup of bouillon; whether, however, the former will be equally well liked is a question. In my experience, I have found that old people usually have an instinctive aversion for bloody meats, and sometimes also for bouillon. Nature often warns man in this way against injurious foods. For patients suffering from diseases of the liver, the use of meat extracts should be strictly prohibited, for we have learned from

the experiments of Pawlow that it is just these extractive substances of the meat which have such a harmful action when derived from the circulation by the liver, which is obliged to destroy the poisons they contain. When the liver is diseased, it is unable to do this. That gouty and diabetic patients will not be benefited by bouillon will have been understood from the previous chapter. While, thus, in certain diseases, meat soups are not indicated, when taken occasionally by healthy persons, they may render good service, but we do not recommend them for daily use.

In children, even large amounts of meat extract are not injurious; on the contrary, as Lehmann has shown in his experiments upon two children who had been weakened by a deficient diet, the taking of large quantities of meat extract caused a daily improvement and development. This is to be explained by the stimulating action of these extracts upon the thyroid, by which, as we have already stated in the first chapter of this work, growth may be stimulated; but for healthy adults and for old persons we would not advocate the daily use of meat juices and extracts.

4. *The Advantages of Meat in Small Quantities, and its Disadvantages in Large Amounts.*

We would probably not be justified in going so far as to consider small amounts of meat as a poison, as is done by so many; even as quite limited quantities of alcohol should not be regarded as a poison. The latter may, indeed, be of some service to many. Meat in small amounts is not only useful, but is absolutely necessary for growing children. For these, especially at the age of puberty, when the growth is stimulated, large amounts of albumin are necessary, in order to meet the requirements of the organism in regard to this substance. The growing child, in which the albuminous tissues are to be built

up, and the adult, who has through disease lost much of these tissues, require a large amount of albumin. We have seen that this is most readily absorbed and assimilated in the form of meat, especially in the cases where, owing to previous illness, intestinal activity is impaired. Another important circumstance is greatly in favor of its use, namely, that probably in no food, and least of all in vegetable foods, can the most important component of an albuminous diet, namely, the nuclein, be so quickly absorbed by our bodies. This has been conclusively shown by the experiments of Jebbink, which have recently been made in Professor Salter's Institute of Chemistry in Amsterdam. There is probably no more important substance in our bodies than this very nuclein, which forms a basic portion of the cell nuclei, from the nucleoproteids of which the nuclein is freed during the process of digestion.

As Aron has admirably stated, the cell-nuclei are the carriers of the life process, since the propagation of the cells is furthered by them. The very important white blood-corpuscles, according to Lilienfeld, contain, in the thymus, for instance, not less than 77 per cent. of nucleoproteids in their dry substance. The spermatozoa necessary for the propagation of mankind and of the lower animals as well consist, to a great extent, of these nucleoproteids, as their heads have a similar composition as that of the cell-nuclei.

Moreover, a whole series of organs among the most important of our bodies, as the glands of internal secretion and the brain,—in fact, all the glandular organs,—consist largely of nucleins; they are the tissues of the body most rich in this substance. It is an undisputed fact that these cellular nuclei are built up with the aid of the nucleins which are absorbed with our food, and which are then used for this purpose. The greatest quantity of and the most rapidly assimilated nucleins are at our disposal in animal food, especially in the form of meat rich in nuclein, such as glandular organs, sweetbreads,

liver, and kidneys, for instance. We may, in this connection, also be justified in resorting to the teachings of organotherapy, now undisputed, from which it follows that when we take portions or extracts of any glandular organ, such as the thyroid or the ovaries, etc., a powerful influence is exerted upon the corresponding glands in our bodies. With this object in view the other glandular organs, such as the kidneys and liver, have been used, and not without results, according to the labors of a whole series of authors. In other words: I cannot convince myself that the substance so important and necessary for our bodies, albumin, which is, for instance, found in spinach, or even in vegetables such as beans and peas, can be used with such good results as the albumin of meat, which so closely corresponds in its composition with that of our bodies, the cells of which it is to rebuild. The animal albumin must, in comparison with others of vegetable origin, be considered as more valuable, and better adapted to take the place of the body albumin, especially when we consider that, according to Fischer and Abderhalden, the various albuminoid bodies, even when they are built from the same stones, as it were, group themselves in various ways, according to the variety or kind. Furthermore, as stated by Osborne and Clapp,[1] the various constituents of albumin, as they are, for instance, contained in wheat, glidin, glutein, and leucosin, give off large quantities of decomposition products. It is, therefore, to be supposed that these differences of the albumin bodies would likewise manifest themselves in their physiological actions and in our nutrition, and that there would be a difference, in this respect, between the animal and vegetable varieties of albumin. When, thus, both animal and vegetable albumins are at the disposal of the body for the building up of its tissues, it is owing to these facts, very probably, that after the absorption in the blood, and the transformation of the albuminoid bodies of various origins

[1] Quoted after Chittenden.

into the albumin of our bodies, the animal varieties are given the preference, *i.e.,* chiefly utilized by our cells.

While, with animal food, more nucleins are absorbed, more organic phosphorus, which is the most useful combination for us, is likewise absorbed, so that we may here also see an advantage in the nuclein-rich animal and fish diet. By this diet, also, which is most important, the action of certain ductless glands, particularly the thyroid, is stimulated, and the increased activity of this gland has a protective influence against infectious diseases, as tuberculosis. This would explain the fact, as has been found by Richet and others, that raw meat possesses a special activity against tuberculosis which is entirely absent in cooked meat. The elucidation of this fact is furnished by the experiments of Breisacher, in the laboratory of Munk, who states that the extractives of meat excite the thyroid, while cooked meat does not have this effect. It is especially to be remembered that the extract of the thyroid gland which is given off into the blood is found in the blood of raw meat, so that the latter will, in the same way as is done by the therapeutic administration of the thyroid extract, stimulate the activity of this gland. It follows, therefore, that in the case of delicate children with a predisposition to tuberculosis, and especially during the period of growth, rare beefsteaks and similar foods should not be spared, while with growing children, particularly at the time of puberty, nuclein-rich foods in the form of liver, kidneys, etc., should be given the preference, since they are also rich in lecithin and phosphorus. In this way the growth of these children will be greatly helped. It is, however, a striking fact in regard to our diet that there is scarcely one of the most useful foods that does not have its disadvantages, and consequently, in the case of adults, and particularly persons of advanced age, foods rich in nucleins may prove very injurious. The nucleins form purin bases during the disintegration process, and from these

uric acid is formed, so that with food rich in nuclein gout is furthered. All such patients, and also those suffering from arteriosclerosis, should avoid such foods, as otherwise the blood-pressure will be greatly increased. In arteriosclerotics a meat diet is harmful, because it increases the inner resistance of the vessels to the blood-stream (Determann). The elimination of sugar in diabetes is also very injuriously affected by such a diet, to which fact I have already called attention in former works. In all the above-mentioned affections meat is not indicated; in diabetes its use must be restricted as far as is possible, and in severe cases should be entirely avoided, for reasons which I have fully explained in my recently published book on this disease.

The milk-egg-vegetable diet is the best for all such patients, and is likewise indicated in many chronic diseases of the intestines, especially where bacterial decomposition influences are present, in which case a meat diet is to be avoided. Neither should it be taken in liver affections, in which the extractive substances of the meat would have a very injurious action. When, in experiments on dogs, as Pawlow has shown, the liver is excluded from the circulation, as by means of an Eck fistula, these dogs instinctively avoid all meat. When it is introduced into the stomach in the form of powder, through a stomach tube, the dogs fare very badly. They show symptoms of poisoning, and would soon die if the meat diet were continued. It is most surprising that bouillon—the extractive substances of the meat—alone will surely bring on attacks. It follows, therefore, that rare, bloody meat and bouillon, in particular, should not be given to liver patients. Meat in general is a poor food for them, and in diseases of the kidneys, except in certain cases, it is likewise not indicated. Boiled and white meats might be given the preference, since the extractives are withdrawn by the cooking process, especially in the case of white meats and fish, in which the tissues are tender,

while in beef, which is so much harder and firmer, these juices are not so readily given off.

While during youth, especially during the period of growth, the use of meat may be very beneficial, when not taken in too large quantities, it is not required by the adult, nor by persons of advanced age; and when, on the contrary, it is taken in large quantities, as in England and America, three times per day, or with us twice a day in large amounts, there is no doubt that the action of the decomposition products may prove very prejudicial to our organs. When therefore, in advanced age, it is not desired to suppress meat entirely (which would be decidedly the best) and to limit one's self to a milk-egg-vegetable diet, which I consider the most rational one for man, it would at least be advisable to take only very limited quantities of meat, and this not oftener than once each day.

5. *Concerning the Neccssity of a Humane Method of Killing Animals.*

When an animal is tormented its glands give off quite an amount of secretion, as the excitement develops in them an increased activity, during which the ductless glands secrete certain poisonous substances, as has been shown in our work on "Old Age Deferred." That the secretion of the ductless glands is thrown directly into the blood is an undisputed fact, and that these glands are more active according to the emotions can be readily seen in animals—as in the stag, when troating—an expression of sexual excitement—the thyroid gland becomes swollen. In some animals the swelling is so great, when they are tormented, as to form a kind of goiter. That this secretion of the gland is thrown into the blood and is then taken up in the muscular tissues—the meat—is best shown by the fact that the meat of male animals, like the steer, has an unpleasant odor. This odor is especially pronounced in the he-goat, and

probably no one would be able to eat of this ill-smelling meat. It is impossible to get rid of this odor. The cooks in Paris, during the siege of the city by the German army, tried in every possible way to do away with this most unpleasant odor of the meat of the male goat, the only meat which was to be had in the best restaurants; they tried strong acids, but to no effect; the odor remained. In the same way it is impossible to remove from the meat of the muskrat the odor of musk which permeates it during the mating season. In the same way as these substances are secreted by the sexual glands, so are others produced by other glands. We know that these glandular extracts, when secreted in large quantities, have certain poisonous attributes—which fact has been unquestionably proven in the case of the thyroid gland. That the sexual glands also secrete such poisonous substances, which have a deleterious effect upon the nervous system in particular, we have likewise shown in our above-named work. That the blood-serum, which contains the secretions of all of the ductless glands, may have a toxic action has been shown by the writings of Richet and others.

These toxic effects also make their appearance when the meat of animals is eaten in which all the blood remains, as, for instance, in the ducks of Rouen, killed in such a cruel way—by suffocation. Deaths have even occurred after eating of them. Meat which contains all the blood becomes very rapidly decomposed, as is also the case with the tissues of the ductless glands as soon as removed from the body.

When animals have been hunted and pursued, the meat contains considerable amounts of extractive substances; this is proven by the much more pronounced taste of such meat, which is rich in these "fright-products." Thus, Liebig[1] found that the muscular meat of a fox which had been brought to bay

[1] Liebig's Annalen nach Schittenhelm zitiert in Oppenheimer's "Handbuch der Biochemie," 1910, S. 537.

during the chase contained a larger amount of creatin than that of others which had been fed in the house.

It is not healthy to eat the meat of a hunted animal; before an animal is killed it ought to be well rested. When we see how farmers' wives often tie up a chicken in a handkerchief so that it takes up as little room as possible on the way to the market where it is to be killed, we can imagine what torments are endured by the animal. It is, consequently, not advisable to kill it on the same day; it should be allowed to recover during a couple of days while being fed upon corn. As was told me at the Etoile Belge in Brussels last year, chickens were sent from Italy to Belgium, making the entire journey without food; some few of the animals had even been eaten up by the rest. Such atrocities should be prohibited by the authorities, first out of humane kindness for the animals, and secondly with regard to health considerations based upon the statements made above. How terrible must be the sufferings of a hare when wounded in the legs by shot, and forced to run, shrieking with pain! The more intelligent an animal is, the more its emotions are excited, and the toxic substances are then also more readily secreted and given off into the meat. The meat of castrated animals, the intelligence of which has been impaired by the process, as is also the case in persons similarly treated, is to be preferred for reasons given in our book on "Old Age Deferred." But even in young and consequently less intelligent animals, as in calves, we may see how they instinctively object to going any farther when they are being led to slaughter and smell the blood of their comrades. If a painless, beautiful death, the "Ευθανατος," appeals to man as a desirable end, this should also be prescribed by law for animals, if only out of consideration for mankind. The eyes of the animal should be bandaged so that it will not suspect its coming end, and will die in a state of composure and in good condition. As I myself saw in Chicago, in the mammoth slaughter houses of the

late Mr. Nelson Morris,—who emigrated, in poverty, from Cannstadt in Württemberg to that city, where he amassed a fortune of 25 millions of dollars,—the animals are stood in a row, and a powerful negro goes down the line, stunning—and occasionally killing—each animal by a blow upon the cranium with a dull axe, after which the animal is hung up and the jugular vein is cut, thus allowing the blood to run out while the animal is still hanging up. As was mentioned above, it is more healthy to eat the meat of animals which have been bled. Since, as already stated, the meat of intelligent animals is more injurious, we can understand how reprehensible is the taste of those who are capable of eating the meat of the dog, the truest friend of man among animals.

After all that has been said concerning the injurious effects of the extractive substances when they are present in large amounts and are frequently indulged in, it follows that we should select a mode of death which would in the first place not cause the animal any anxiety, and avoid all pain. Even the elementary rules of humanity would require us to do this, although we may not be always able to follow the lofty teachings of the old philosophers of Hindustan in our battle for life, which decried the killing of any animal as an immoral procedure. Indeed, one sometimes sees persons in India throwing rice on the grass, so that insects may feed upon it.

One should at least carefully see to it that the animal is not unnecessarily tormented. It is, however, so arranged in this world that some animals can only keep alive by taking the life of some other animal. In nature, during every minute of the day or night, in fact, wholesale murder is being carried on, in the air, in the water, above and below the earth, and, with vegetarian principles, a tiger or a lion, for example, would soon be no more. If man, whose foods are very varied, must follow this course, which is tolerated by all God-believing religions, he should, at least, spare the animal all possible pain. And

if he will not do this out of humane feelings, he should, in view of what has been said above, do so out of consideration for his own well-being. That the taste of meat can be improved thereby was already known to Shakespeare, who says in the Merry Wives of Windsor, Act I, Scene I, "I wished your venison better; it was ill killed."

(*b*) Fish Diet.

I. *Nutritive Value and Other Properties of Various Kinds of Fish Foods.*

The doctrines of certain churches, as the Roman Catholic, the Greek Orthodox, as well as the Anglican Church, forbid the use of meat during certain weeks of each year, and also on one day of each week, and recommend the use of fish. This fact corroborates the correctness of the statement made in our work on "Old Age Deferred" that the practice of a religious faith has a good influence in prolonging our life. Fish is more easily digested and is much better, for certain reasons, than meat. When one has at different times eaten an equally ample quantity of meat and fish, he usually feels less weight in the stomach after the fish, and this when even a rather larger quantity of lean fish is taken than of the meat. Fish in general have a much more tender flesh, they contain more water than meat usually does, and, while their fiber is more tender, they are, nevertheless, nourishing. Some varieties of fish do not contain any less albumin; some, in fact, the salmon, perch, and pike, for instance, have even more than some kinds of meat. This form of albuminous food has the advantage that, with the exception of some few kinds of fish, such as the carp and salmon, the albumin is associated with other quite harmless substances, and, owing to the very limited amount of extractive substances, much fewer harmful products are formed than

is the case with meat. In order, however, that fish outrank the meat as a diet, it is requisite that the fish be absolutely fresh, for there is no kind of meat which spoils so rapidly as fish. Owing to this, it is advisable in the hot summer weather to dispense with fish unless one has the good fortune to live near the water, so that one may be sure of eating the fish on the day it is caught. The Aztecs were well aware of the fact that fresh fish is a much more healthful food than meat; the Emperor Montezuma ate it daily, the fish being brought from distant shores by runners. It is much the best when the fish—which is possible in the fresh-water varieties—is brought to the kitchen alive, and is killed only a very short time before it is to be used. The meat of such fish has a different appearance from the others; the trout looks blue and the meat of the cod or haddock is firm. In Holland one may often see the fish dealer kill the fish just as he is delivering it, making deep incisions into the quivering body; this causes contraction of the flesh, which can only be seen in perfectly fresh cod or haddock. The eel is treated even more barbarously, for, in the belief that the meat tastes better, the skin is pulled off while the fish is yet alive.

Just because fish contains much less flavoring substance than does meat, it is most important that it be fresh. Nowhere else is it possible to eat such good-tasting sea fish as in England and Holland, and in Sweden and Norway, because it goes directly into the hands and stomach of the purchaser. In Paris and in other cities of the Continent it is more difficult to obtain such fish, and the longer the fish travels on the ice the more it loses its taste. This does not mean that it loses any of its merit as a healthful food when well packed in ice and eaten soon after its arrival. Generally speaking, a fish diet is most healthful when the fish is eaten at not too great a distance from its home. The taste of the fish depends, as does that of meat, upon its food and its abiding place. Usually the fish living in

deep water, and those of mountain streams, are the most healthful; those living in unclean, muddy water are much less so, and Galenus already decried the use of such fish, especially when they are caught in waters below a city.

The use of fish without scales was strictly prohibited by Moses,[1] and it is very interesting to note that the same law exists among the Hottentots and the Bushmen in South Africa, who, like the Jews, do not eat pork. Certain fish found in tropical regions, as in Cuba, Florida, etc., are very poisonous. In these sections there is a phenomenal quantity of fish, as I was able to observe during a two weeks' stay in Miami and Palm Beach, in Florida, during the winter of 1906-1907. Owing to the fact that many of these fish eat poisonous medusæ and other harmful substances, decomposed bodies, etc., their meat becomes poisonous. When, however, care is taken to at once remove the head and intestine when they are caught, the meat proper may be eaten without fear of untoward results.

Fresh fish is not only the best, but it is the most readily digested; it tastes best when fried or baked, as by boiling the savory elements are even more easily drawn out from the fish than they are from meat. Smoked fish is quite as digestible as boiled fish, but the same is not the case with the dried and salted varieties. Penzoldt found, in regard to the digestibility of fish, that ¼ kg. of whitefish was digested in two and one-half to two and three-quarter hours, while the same quantity of meat took three and one-quarter hours. Herring required the most time,—about four hours. According to Rubner, Atwater, and others, fresh fish meat is quite as well assimilated as beef, as will also be seen in the writings of Langworthy, who found that, of the fish, only 5 per cent. of albumin and 10 per cent. of fat were lost. Slowzoff recently affirmed that freshly cooked fish was even better assimilated than meat; he also found that smoked fish was as well assimilated as that

[1] Leviticus, ix, 9, 12; after Pavy.

which was cooked, but the salted and dried kinds more poorly so than the cooked fish. He found that the nitrogen was the equivalent of that in meat.

In addition to the albumin and considerable quantities of gelatin, fish also contains valuable mineral salts in not inconsiderable quantities; some varieties contain much phosphorus. Slowzoff states that these nutrient salts are also better assimilated than those of meat, and that more phosphorus and magnesia are absorbed.

It will be seen from the above that a fish diet is a very advantageous form of nourishment, and that from it we get large quantities of nutritive substances. We shall show in the following list by König[1] how many calories are obtained from a fish diet, and how much of the various nutrient salts is found in the kinds of fish which are chiefly eaten:—

	Nitrogenous substance. Per cent.	Fat. Per cent.	Salts. Per cent.	Calories contained in 1 kg.
Fatty fishes.				
Salmon	21.14	13.53	1.40	2136
Herring	15.44	7.67	1.70	1370
Eel	12.80	28.40	0.90	3190
Carp, fed	16.67	8.73	....	1045
Carp, not fed	18.96	1.85	1.30	870
Whitefish	16.30	7.90	....	1980
Lean fishes.				
Pike	18.42	0.53	1.20	909
Haddock	16.93	0.26	1.30	816
Trout	19.20	2.10	1.20	980
Perch	18.50	0.70	1.30	960
Cod	17.00	0.30	1.30	720
Plaice	16.00	1.40	....	900
Sole	14.20	0.50	....	730
Turbot[2]	17.60	2.10	....	1040

We shall now give after König, ii, S. 483, the nutrient salt content of two fishes, from which an approximate idea of the salts contained in others may be formed:—

[1] After König, ii, 1468.

[2] The last three fishes, as well as the analysis of the whitefish, are quoted from Schall and Heisler.

Nutrient Salt Content.

The ash contains	Potash. Per cent.	Soda. Per cent.	Phosphoric acid. Per cent.	Sulphuric acid. Per cent.	Chlorine. Per cent.
Codfish	13.84	36.51	13.70	6.31	38.11
Pike	23.92	20.45	38.15	2.80	4.75

As this table shows, fish meat is characterized by a high content of soda and a low amount of potash. The quantity of common salt is naturally quite considerable in sea fish. When the fish are salted down, the amount of salt is greatly increased; the fish are placed in tubs and are covered with brine. The longer they remain in the brine, the more salt they absorb. This influences their digestibility in a very unfavorable way, as has been already stated; it may be imagined how injuriously the kidneys will be affected when such large quantities of salt pass through them. Such fish are, therefore, certainly not healthful.

The best method of preparing the fish with regard to their digestibility is by boiling or frying. Since, however, the flavoring elements are so readily given off, and there is, consequently, very little taste left, possibly the only way to retain it is by steaming.

It will be necessary, as previously emphasized, to see that the fish is always fresh. There is no article of food in which this is more important, particularly in the summer. The decomposition processes occurring in fish may, otherwise, give rise to the much-dreaded ptomaine poisoning.

The Indian tribes of Oregon had the habit of burying salmon in the ground, and, the more it was decayed, the better they liked it.[1] The inhabitants of Greenland and the other Eskimos do the same with seals. Dried and strongly smelling fish seem also to be a favorite food with the Chinese and

[1] Wilkens: U. S. Exploring Expedition, iv, p. 451, after Pavy.

Malays in Java and in the Archipelago. In Java, *trassi,* the meat of dried shrimps, is eaten after having been kept for many months. While I was the guest of a family in the Hague who had possessions in India, I had the opportunity of tasting this. It had a most unpleasant odor, but did not taste badly. It might be here mentioned that trassi, as has been stated by Jebbink, is very rich in phosphorus, probably as much so as any article of food; its total content of phosphoric acid amounts to 2.27 per cent., and, of this, 2.21 per cent. is soluble and digestible.

While fresh fish, in general, does not keep very well, this is particularly the case with fatty fishes, for very soon, sometimes after one day, the quality of the fat undergoes a change and it has a rancid taste, as in the eel and the salmon. Yet, these two kinds of fish are the best flavored among them all, and have, likewise, the greatest nutritive value. They have the disadvantage, however, and the eel most particularly so, of being very difficult to digest not only on account of the great quantity of fat contained in the eel, but also because of its very unappetizing habits. I would call it the pig among fishes. It likes to roll in the mud, and in water containing waste products of all sorts; where the water is stagnant and cannot run off, as in the Dutch canals, the eel tastes the best. The variety living in clean water has not nearly so good a taste as the river eel, and particularly that living in the ditches and canals in Holland. It is said of this fish that it eats the most unclean things, and it was stated that the eels caught near the Dutch Lazarettos, in the Dutch Indies, fed upon the bodies of the dead, together with refuse of all sorts, and that, with it all, their meat had a wonderfully good taste! Something of the same nature has been recorded in history of Vadius Pollonius, who fed his *murænæ,* a kind of eel, with the flesh of slaves who had been killed just for this purpose, in order that they should have a better taste. That the meat of the eel

sometimes causes toxic disturbances may no doubt be referred to its unclean mode of living, and we may find in this instance an exception to the rule that everything which has an agreeable taste is good, and agrees with one. The meat of the eel can in no way be regarded as a healthy food. The salmon might rather be recommended for a normally healthy person, since it is not quite so fat as the eel, and always lives in clean water. Owing to its fat content and its very compact meat, salmon is not easily digested, and is not indicated for people suffering from stomach and intestinal disorders. According to some authors, who found that salmon contained considerable quantities of purin bodies, it is not to be recommended in gout and arteriosclerosis. Lately, however, Bessau and Schmidt found in both the eel and the salmon much smaller quantities of purin bases; in 100 grams of each fish there were 0.024 gram (salmon) and 0.027 gram (eel).

The salmon usually prefers the northern waters; in Europe it is found in large numbers in the Norwegian and Swedish waters, and when in very cold winters the seals come farther south they eat up all the salmon of the Swedes and Norwegians; it is for this reason that in these regions there is an actual massacre of seals. Whoever likes good salmon fishing should go to Canada, where the lakes in the province of Quebec are full of these fish. Wonderful stories were told me of the size and quality of the salmon while I was in Quebec, four years ago, during the winter.

Another very popular fish, the herring, also prefers the waters of the North. We unfortunately only get this fish, which is so excellent when fresh, in the salted or pickled form, and then it is not quite so good, nor is it a healthy food substance. I have eaten very good fresh herring in England. In the Lake of Garda there is also a variety of that fish which is excellent. The amount of salt contained in salted herring is often very considerable after it has been in the brine for some

time. König states that herring which has been lying in brine for three days contains 9.5 per cent. of salt; after nine weeks it contains 17.7 per cent., an amount which is certainly prejudicial for the kidneys.

The value of fresh herring is increased when it contains the roe or the milt. Of the fatty fishes, the one most easily digested is the whitefish, which the English (Pavy) call the "sea chicken."

The best-tasting and probably also the most easily digested among the fat fish varieties is the carp. In Berlin, particularly, great quantities of this fish are consumed. Unfortunately, however, the carp contains—it is unfortunate that so often with the best goods there must be a "but"—a large amount of extractive substances. According to the latest analyses of Bessau and Schmidt, the carp contains more purin bases than either the eel or salmon, 100 grams containing 0.054 gram. The herring contains more extractive substances: 0.064 gram. Small fish in general, such as anchovies and sprats, contain the greatest number of purin bases; also the sardine, which has the large amount of 0.118 gram purin bases in 100 grams. While the carp, however, gives off a portion of its extractive substances during cooking, this is naturally not the case with the sardine. Another fish which is considered as one of the most healthy as food, the trout, contains, according to these authors, a like amount of purin bases. There is probably no fish which is so well liked in our Carlsbad diet as the trout, and, as a matter of fact, the meat of this fish is quite easily digested. When we consider that, just as is the case in meat, a hard, tough condition prevents the elimination of the extractive substances through cooking—as in beef, for example—the opposite condition probably exists in the trout; for just as the tender meat of the calf gives off its extractives in cooking, so does also the soft, tender trout. A fresh, well-cooked trout has very little of the flavoring substances left, and may without hesi-

tancy be recommended as a food for arteriosclerotics and gouty patients, as well as in diabetes.

With regard to the digestibility, the sole, which also has a tender fiber, resembles the trout; also the plaice, which is eaten in large quantities in England and in Holland, and is of a fine quality. The turbot would probably come next. The haddock is rather more indigestible, owing to its tough and hard fibers. This fish is best eaten in Norway. It has an excellent taste and, when perfectly fresh, is not so hard to digest; so that we can readily understand the predilection of the Norwegians for this fish, and the current saying, *"Jeg aer Norsk, Jeg spiser Torsk."* On the other hand, the same fish, when I ate it in Barcelona, where it is called "baccalau," did not taste nearly so good; neither did I care for the "cabillaud" in Belgium and France. The salted codfish, because of the salt, has very hard fibers, and might be rendered more palatable if the salt were first well washed out in plenty of water, and the fish cooked for some time. It will then not only taste better, but it will also be more readily digested. The cod is, in itself, not a very easily digested fish, owing to its tough flesh. It might probably represent beef among the fish varieties, particularly since it contains more albumin than the plaice and sole. Kanianizin made a series of experiments on the digestibility of this fish in the prisons of St. Petersburg, and found that it was quite as well digested and assimilated as beef. While hearty eaters make the objection that they have nothing in their stomachs after having eaten fish, I can affirm, by my own experience, that such is not the case as regards codfish.

2. *The Advantages of a Fish Diet.*

With the present high cost of living, when the poorer classes cannot afford to buy meat, I cannot see why a fish diet is not more generally indulged in. With our improved trans-

portation facilities we are able to send sea fish, which in some regions are caught in such enormous quantities, to a great distance, and yet are able to supply the consumer so that they may be eaten on the same day. In this way a food substance is furnished which is not only, when eaten while fresh, much more healthful, but is also much cheaper, than meat, even those meats imported from Australia and the Argentine Republic. Aside from this, it is decidedly preferable to eat a fish which is only one or at most two days old, than meat which has been preserved on ice for weeks. There is probably no other food substance, with possibly the exception of cheese,—in which we have an animal albumin, the value of which we have already stated,—which can be purchased at such a moderate price as many varieties of fish. Fish meat also has many advantages, some of which have already been mentioned. First of all, I wish to again emphasize the digestibility of fish as compared with that of meat, and it is quite certain, as I have myself been able to determine, that fish does not remain as long in the stomach as meat, and that one consequently has a better appetite for the next meal. When, therefore, one has a weak stomach, the tender meat of some of the white fishes referred to in the last chapter is a much more appropriate food. It is also a great advantage—to which we desire to call attention—that one is able to take in combination with fish certain valuable foods which can probably never be taken with meat, as, for instance, the roe and milt. Both are rich in phosphorus, and the roe contains some iron. These are perhaps the most valuable components of fish, since they contain as much as 30 per cent. of nitrogen and 20 per cent. of fat. I might add, however, that in some kinds of fish, like the salmon and pike, these structures, as well as the meat itself, have certain toxic properties during the breeding season, and should therefore not be indulged in at that time. The eggs of the sturgeon (caviar) will be treated of in a special chapter.

As an albuminous food fish has, furthermore, the very great advantage that patients suffering from kidney and liver disorders, or from gout, may take this form of albumin, which contains much less of the injurious substances than that of meat, since in fish there is a smaller proportion of extractives, —with the exception of the smaller varieties,—while those having tender fibers give off more of these extractives during the process of cooking.

With few exceptions less uric acid is formed with a fish diet than with one of meat; and since it is often very difficult to induce a gouty patient, who has been a meat-eater for years, to give it up entirely, he might be allowed to eat fish at least once a day. With diabetic patients, as I have stated in my book on diabetes, I have observed that the eating of fish, such as the "schill" and the perch-pike, causes much less sugar elimination than is the case with meat, and by using such a diet with the addition of green vegetables and some carbohydrates (fruit, rye bread, graham bread, etc.) I have more easily arrested the elimination of sugar in Carlsbad patients. In the treatment of arteriosclerosis I have likewise obtained great benefit from the use of tender white fish. The fish diet is especially useful as a transition food between the meat and the milk and vegetable diet. We first leave off the meat and replace it by fish, which is after some time also abandoned, and the albuminoid portion of the food is made up of cheese or cereals. The use of fish in the diet of brainworkers, as a component article of food, when exhausting literary work is to be done, and also the influence of fish upon the sexual activity and upon the intellectual activity, will be dealt with later on.

All of the above advantages, however, depend entirely upon the fresh condition of the fish. Such as have been kept for a long time have lost all taste, as I was able to convince myself during my ocean voyages to and from America. I was, for this reason, only able to eat the fish during the first few days.

This loss of taste is not the worst feature. The poisoning by fish has already been mentioned, and very frequently eczema and other skin rashes make their appearance after eating stale fish. Strange to say, I most frequently saw such cases among my French patients—last summer in a colleague, and in two other gentlemen from Paris. The patients assured me that every time they ate fish their old eczema was sure to manifest itself again. One of these patients did not suffer from eczema after eating trout at Carlsbad, because these fish were only killed just as they were to be cooked. These toxic symptoms may have been due to the fact that the fish suffered before death—through unsatisfactory modes of transportation, insufficient quantities of water—and this perhaps unclean—and that this gave rise to the formation of "fright products," which acted like poisons, already referred to when speaking of the killing of animals. The fish must, immediately after having been caught, be placed in large receptacles containing fresh and, if possible, running water, a sort of aquarium as it were, where they remain until just before they are to be used, when they should be very quickly killed.

Frequently, when injurious effects follow the eating of fish, these may be due not so much to the fish itself as to the addition of bad sauces made with bad butter, or with spoiled cream. This state of affairs usually only occurs in restaurants, and here the preparation is more to be feared than the fish. Soup made of fish is a valuable and agreeable food substance. The "halászlé" (fish soup) made in Hungary is a very excellent fish food, particularly that made on the shores of the Platten See (Balaton) of the fish found in its waters, the world-renowned fogas (Fogorsh). This is a kind of fish goulash, but true gourmands prefer the "fogas" when broiled upon the spit. We consider this fish a most excellent one, and a very healthful food.

(c) Oysters and Shellfish; their Advantages and Disadvantages.

When we read, as has been related by Brillat Savarin, that while he was acting as Envoy of the Directory during the great revolution he dined with a Monsieur Laporte, who ate oysters during a whole hour, and consumed 32 dozen of them (which did him so little harm that he managed very well with the rest of the dinner), we must conclude that oysters must have been much cheaper one hundred years ago, and that at that time typhoid epidemic due to the eating of oysters did not occur. The latter was reserved as a blessing of our times, with our fully developed canalization! We can, to be sure, understand the appetite of Monsieur Laporte and his contemporaries, who could not content themselves with less than a gross (12 dozen) of oysters, for in order to obtain sufficient nourishment from these bivalves a great many of them must be eaten. An oyster contains about 5 to 6 per cent. of albumin, 1 per cent. of fat, 3½ per cent. carbohydrates, so that in 1 kilo of oysters 520 calories are contained. It would therefore be necessary to eat a very great number of oysters, and if these were the best of their kind, the Zealand oysters, or those from Ostende or Whitestable, one would have to be a multimillionaire, like those owning palaces on Fifth Avenue in New York, to stand the cost. Vitellus was quite right when, about two thousand years ago, he called this food "cibis nobilium."

It is quite easy to eat a great many oysters, because they are very easily digested and because they also stimulate the appetite, so that they are to be recommended for persons suffering from lack of appetite. They can be well digested by all convalescents and weakened persons. It is because they tend to stimulate the appetite that oysters are served at the beginning of a meal.

Oysters are perhaps the only animal food which we eat raw, and, so to speak, living, for they are only healthful when they are perfectly fresh. It is possibly just this circumstance which exerts the stimulating and excitant action of the oyster diet, which, as we shall refer to later, is said to have an influence upon sexual activity. The Romans, those dissolute gourmands, had toward the end of their Empire very productive oyster beds near Bajæ, and, as Pliny and Horace have related, they were great lovers of the succulent bivalve.

Just as raw meat has useful properties against tuberculosis, so did Boerhave detect a similar effect in oysters. Since the valuable properties of the oyster are entirely lost after they have been cooked, these must be contained in the extractives, in the juice of the raw oyster. It is a very great pity that at present the eating of raw oysters is frequently productive of quite serious danger to the health, for in some regions the sewage water is emptied very near the oyster banks, which frequently contain typhoid bacteria; and it is a fact that in some large cities, as in Paris, for instance, rather serious epidemics of typhoid fever usually occur about three or four weeks after the Christmas season, or during the early months of the winter, owing to use of such infected oysters. During the past few years, however, conditions have improved, and the authorities in the regions where there are oyster beds and colonies have enforced strict regulations in regard to the cleanliness and purity of the water. The government of the Netherlands, for instance, went so far as to examine and to prepare cultures of the water in laboratories, in order to convince themselves that no injurious bacteria were contained therein, so that the oysters could be eaten with safety. We consider oysters a very healthful, although not very nourishing, food, which is best adapted for the use of patients and convalescents, as well as for gourmands. Hutchison states that in 12 oysters there are only 5 grams of digestible albumin, and,

according to Stutzer, 1 egg contains as much nourishment as 14 oysters.

Mussels may even be more dangerous when eaten raw; recently a severe typhoid epidemic was caused by them. Mussels are more nourishing than oysters, as they contain more albumin; in fact nearly twice as much as the oysters, about 9 per cent., and about the same amount of fat and carbohydrates. The mussel, however, is more difficult to digest, as the meat is tougher. It is certainly safer to always have them cooked, as they, as well as the oysters, may not only cause typhoid, but may also give rise to severe poisoning cases, and also to intestinal catarrh, when they grow in water which contains poisonous matter.

Symptoms of poisoning are also frequently caused by eating crabs. Their meat has a very agreeable taste, but they, like their larger brothers of the ocean, the lobsters, eat decayed and putrefied substances and injurious meats, and very frequently urticaria and other eruptions occur after their ingestion. In one case which I observed, that of an English clergyman, the entire right arm was swollen after he had eaten some lobster; the swelling soon disappeared, however. It is most important that these crustaceans should, as soon as they are removed from their own element, be placed in boiling water, and they should likewise be eaten soon after they are cooked—possibly a day later. It is certainly a barbarous habit to do as some cooks do, who put them into cold water and then let them boil slowly, instead of at once putting them into water which is already boiling. It may possibly have been this method of cooking which caused the poisonous symptoms. The meat is very compact and is difficult to digest. Owing to the hardness of the meat, however, it is necessary that it be well masticated, and it is then rather more easily digested, when not eaten in too large quantities. The lobster being eaten cold, this also may affect the digestion unfavorably.

Sometimes lobster soup has caused cramps. It would certainly not be advisable for the author of a book on rational dietetics to recommend the eating of crabs or lobster.

For economical reasons I must, nevertheless, say that these crustaceans contain much nutriment. Lobster, according to Payen, contains from 13 to 19 per cent. of albumin (thus approximating beef) and about 1 per cent. of fat. Crab contains, according to König, 10 per cent. of albumin, 0.4 per cent. fat, 1 per cent. carbohydrates, and 100 grams of the meat give about 80 calories. It must also be remembered that they, like the oyster and mussel, are very rich in certain nutrient salts, phosphorus in particular[1]; lime is also present in fair amounts. If we are desirous of absorbing these salts in such foods, it would be better to eat the shrimps and small crabs; these are also more easily digested when well masticated. Quite a number of these small crustaceans can be used at one time without untoward effects, and in some resorts at the seaside, as at Ostende, the physicians order their patients to eat shrimps already at breakfast, as they are considered a healthful food. The influence of these crustaceans upon the sexual functions, which has been praised since ancient times, I shall discuss later on. According to König, crabs contain 15.8 per cent. of nutrient substance, 1.32 per cent. of fat, and 2.42 per cent. of carbohydrate.

We do not wish to close this chapter without referring to two animals having shell-like habitations, *i.e.*, the tiny snail and, as a contrast, the large tortoise. The snails found in the vineyards in France and in Spain, where they are called "caracoles," are eaten in large numbers. Personally, I did not find them very good, and I consider them hard to digest. The gelatinous meat of the tortoise is preferable, and the "real

[1] According to Gautier, the meat of the lobster contains 2.20 per cent. of organic phosphorus.

turtle soup" used in England has quite a stimulating effect on the appetite. This is, however, its chief advantage.

(*d*) The Advantageous Properties of Eggs.

After milk, there is probably no other article of food which is so valuable for mankind as the egg, and scarcely any other food substance possesses so many useful properties. Of the nutrient substances, eggs contain large quantities of albumin and fat. The amount of nourishment contained in an egg corresponds with that in 40 grams of fat meat or about 150 grams of milk.

If we allow 60 grams to an egg, the shell contains 7.2 grams, the white of the egg 35.4 grams, and the yolk 17.4 grams. The percentage would be divided about as follows:—

The shell	12 per cent.
The white of egg	58 per cent.
The yolk	30 per cent.

Eggs likewise present the great advantage that in addition to their albumin and fat content, and consequent nutritive value, they are very readily digested, and are better assimilated in the body than the great majority of foods.

Raw eggs are the most difficult to digest, since, owing to their fluidity, they cause very little secretion of saliva, and are apt to coagulate in the stomach. Soft-boiled eggs are very much more digestible, and even the hard-boiled eggs are not so indigestible as is claimed by many. As a matter of fact, hard-boiled eggs are often more easily digested than raw ones, as I have been able to determine both in my own experience and in that of my patients. It is important, however, that the hard eggs be well masticated; their digestibility depends upon this.

According to the experiments of Jaworski and Gluzinski, hard-boiled eggs, when finely chopped and taken with water, remain in the stomach only one and one-half hours.

If with many persons there is a difference in regard to the digestibility of the hard and soft eggs, there is no difference as far as the assimilation is concerned.

According to Rubner, even when 21 hard eggs had been eaten,[1] they were as well assimilated as meat, so that only the following small quantities were lost:—

Dry substance	5.2 per cent.
Nitrogen	2.9 per cent.
Fat	5 per cent.
Ash	18.4 per cent.

Eggs are therefore a very valuable and easily assimilated food. In addition to this they have the following advantage, which is shared by very few foods: they contain no injurious substances. In meat, in addition to the albumin content, there are the extractives, and consequently much meat may prove injurious. This is not the case with the egg, where the albumin contained does not cause the formation of any injurious product, such as uric acid; neither does it increase the sugar in diabetes, as other albumins do, and this in spite of the fact that it contains carbohydrate molecules. This proves that the secretion of sugar, as I have already stated in my previous works, is often less frequently caused by carbohydrate-containing foods than by those free from the carbohydrates, and that some toxic irritant is in question. If various foods really do have a toxic action owing to their decomposition products, this scarcely comes into consideration in the case of the egg. Eggs may be considered as one of the most healthful among all foods, but, naturally, only when they are fresh, or are in the wintertime preserved in a rational manner.

The great nutritive value of the egg may be seen in the following table by König:—

[1] Rubner: Zeitschrift für Biologie, 1879, 15, 115.

A fresh egg contains:—

Water.	Nitrogen.	Fat.	N-free extractives.	Ash.
73.67 per cent.	12.50 per cent.	12.02 per cent.	0.67 per cent.	1.70 per cent.

In the dry substance:—

Nitrogenous matter.	Fat.	Ash.	Nitrogen.
47.46 per cent.	45.67 per cent.	4.06 per cent.	7.64 per cent.

The white of egg contains 12.77 per cent. of nitrogenous substance, and the yolk 16.05 per cent.; the white contains 0.25 per cent. of fat, while the yolk contains a very large amount, 31.70 per cent. In an egg weighing 48 grams there are about 6.4 grams of nitrogenous substance and 5 grams of fat.

Together with this high nutrient value, eggs also contain other important substances which play a great rôle in the building up of and in the functions of the central nervous system, such as lecithin, of which the yolk of the egg, according to Gobley, contains 7.2 per cent. There is also about 1 per cent. of salts in the yolk. The amount of phosphorus is quite large; in 100 grams of the yolk there is 1.279 grams of phosphoric acid, as stated by Juckenak. The yolk is also said to contain some brain substance, *i.e.*, protagon, which is decomposed into cerebrin and lecithin.

In view of the above, eggs are to be recommended as a food for persons suffering from nervous depression, neurasthenia, etc. To be sure, it is not sufficient, as we shall show later on, to simply give large amounts of food containing phosphorus and lecithin, in order to cause the brain and mind to functionate better, as all this is not accomplished merely by the absorption of such substances. They must be made use of and assimilated, and this depends upon other factors. It is in no sense a rational proceeding to take expensive products for the purpose of introducing lecithin and phosphorus into the body, when this can be better accomplished with fresh eggs.

To the great content of the egg in nutrient substances and lecithin must be added the quantity of other substances

which make the egg, like milk, one of the most complete food-stuffs; these substances are certain mineral salts, especially oxide of iron and lime. The iron contained in the egg is 0.39 per cent. of the total contents. According to Bunge, in 100 grams of the yolk of eggs 0.01 gram of iron is contained. According to the calculations of Hutchison, we can obtain from 7½ eggs all the iron required daily by the organism, which quantity, according to Stockmann, is 10 milligrams.

We show, in the following table according to Pollak and Weber, the quantity of the various nutrient salts contained in eggs:—

NUTRIENT SALTS CONTAINED IN EGGS.

	Potash. Per cent.	Soda. Per cent.	Lime. Per cent.	Magnesia. Per cent.	Oxide of iron. Per cent.
White of egg	26.6 —39.4	23.5 —32.9	1.74— 3	1.70—3.71	0.44—0.55
Yolk of egg	8.93—10.90	5.12— 6.75	11.1 —13.2	1.07—2.11	1.19—1.45

	Chlorine. Per cent.	Phosphoric acid. Per cent.	Sulphuric acid. Per cent.	Silicic acid. Per cent.
White of egg	23—28.8	3.16— 4.81	1.32—2.63	0.28—2.04
Yolk of egg	—	63.8 —66.7	—	0.55—1.40

It might be well to add that, according to the experiments of the French chemist Bertrand, in the Pasteur Institute, eggs also contain a trace of arsenic; ducks' eggs have more of it than those of chickens.

When several eggs are eaten daily, it will be seen by the table given above that a quantity of important nutrient salts, such as phosphorus, iron, lime, and silicic acid, is absorbed by the body, and this, as I would specially emphasize, in an organic form. Why should expensive drugs containing iron be bought when we can get the same results with several eggs?—not to mention the fact that most valuable nutritive substances as well as other nutrient salts are combined with it, which are, besides, easily digested and assimilated; this cannot always be said of the iron-containing drugs.

For persons suffering from anemia, as well as for chlorotic young girls, it is advisable to eat several eggs daily. One

advantage of this is the fact that diseases such as tuberculosis, etc., which are liable to occur after these conditions, are more easily prevented. The great amount of albumin and the iron contained in the eggs make them one of the most valuable foods in all cases in which it is desired to encourage the formation of blood. For this, eggs are to be given the preference, since, even when taken in considerable numbers, they do not exert any untoward effects on the uric acid diathesis. Gouty patients can also take eggs without injurious results. The egg diet is especially useful when meat is excluded, and it is taken in combination with milk, carbohydrates, and vegetables, as well as fruit, eggs forming one of the main components of the diet. With 4 eggs each day about 280 to 300 calories are obtained, which are about one-eighth of the daily nourishment required; and since in a diet not overrich in fat and carbohydrates about 6 eggs daily would be required, we would already have about one-sixth of the total food necessary. The most important fact is, however, that with the 6 eggs we easily have a half or even more of the albumin ration necessary for the day, since they represent about 36 grams of albumin, of which but very little is lost. It will, however, only be possible to give so many eggs per day in the usual food, if an extremely limited quantity of meat is indulged in. Otherwise, with the simultaneous absorption of added amounts of carbohydrates and fats, overnutrition and fatty degeneration would very soon occur. When, however, it is desired to bring about such a result, viz., in a fattening treatment, as a preventive against hereditary disease tendencies, tuberculosis, etc., eggs would be a most useful food, particularly for children or at the time of puberty, owing to the absorption of so much albumin, together with the lime, phosphorus, and iron.

In the case of diabetics, for whom, for the reasons I have already given in my work, "On the Ways and Means of Treating Diabetes," it would be most rational to exclude meat from

the diet for a certain time, the taking of eggs together with milk free from sugar, and with green vegetables, may give very good results, especially since they do not increase the sugar secretion, except in very aggravated cases of diabetes.

An egg diet is indicated wherever the albumin of the body is deficient or lacking, as after exhausting illnesses. When cooked they form an excellent food in kidney troubles, as their albumin does not at once come into contact with extractives which might irritate the kidneys. It is quite erroneous to look upon their use with fear in cases of this sort, for even in chronic inflammatory conditions of the kidneys no injurious effects will follow. Although the taking of a great many raw eggs does cause a secretion of albumin even in healthy persons, we should not refrain from their use, since the albumin which is eliminated is the unchanged albumin. Several boiled eggs daily may be taken without the least fear in kidney troubles; indeed, it has been observed that patients having chronic affections of the kidneys can often take a number of eggs without any noticeable increase in the amount of albumin excreted.

In addition to their high content of nutritive organic and mineral substances, eggs have the very decided advantage of being useful in the kitchen for a great variety of purposes and in the preparation of many excellent dietetic foods. The eggs may themselves gain in nutritive value if combined, *e.g.*, with carbohydrates, in which they are lacking. When eggs are mixed with fine wheatflour we have a more complete food, which contains all three of the important classes of food substances. Of this nature are macaroni, egg-noodles, and other similar foods which contain the yolks of eggs. It may be found very advantageous to combine beaten eggs with sugar and good wine, thus forming the easily digested "Chaudeaux"; from white of egg, combined with sugar and cornstarch, cornflour, "mondamin" maizena, etc., blanc mange can be made, which is also very digestible. Eggs generally combine very

well with cornflour, and I remember that in my childhood days dear departed mother gave me a drink made of cornflour, the yolk of egg, milk, and honey when I had a cold, and that this acted very beneficially. Indeed, I often longed to catch cold in order to get some of this agreeable beverage. Eggs mix well with milk, and in this way the nutritive value of each is considerably increased. Raw eggs may be given in milk. As they are not very easily digested,—not only because they do not induce a sufficient secretion of saliva or of gastric juice, but also because of the keratin membrane contained in the fluid portion of the egg,—it is perhaps advisable to strain this fluid through a piece of thin linen, or, better still, after one minute's boiling, to put only the yolk of the egg into the milk. Cream and eggs also mix well. The nourishing properties of certain foods which do not furnish any very great amount of nutritive substance can be much enhanced by the addition of eggs. I frequently recommend to my patients the addition of the yolks of 2 eggs, previously boiled for one minute, to a vegetable purée, as of spinach, or to mix them with carbohydrates as in oatmeal porridge, or with soup. This addition also greatly improves the taste; that of milk is likewise improved by the addition of yolk of egg. It is, of course, necessary that only eggs of the very best quality be used. The question of good quality and taste is perhaps more important in eggs than in many other food substances, as eggs, at the best, have not so very much taste. They must be fresh for drinking,—the very choicest eggs; in fact, in general the very best quality should always be purchased, notwithstanding their comparatively high price. As with all foods of animal origin, much depends upon the care bestowed upon the animals furnishing the eggs. Chickens thrive best when kept in the open air, just as do cows, and give the best eggs under these conditions. Eggs laid when the hens are fed upon corn are usually better than when the food consists of worms and insects. It must be remembered

in feeding chickens that they are expected to furnish in the eggs a food which should contain much albumin and fat, as well as lime, since the shell of the egg is also to be considered. These substances should therefore be supplied in their food, as in oyster-shells, for instance, which they will eat greedily if the shells have first been pulverized. Unfortunately, fresh eggs are often only to be had in the spring and summer; late in the autumn and in winter they are difficult to obtain, and then the stored eggs must be resorted to. The process of storage should also be hygienically conducted. Eggs will keep best in a 10 per cent. solution of potassium silicate, or in a dilute glycerin solution. Keeping them in lime-water is less satisfactory. Great care must be taken, in storing eggs away, that the hands be perfectly clean. One should never suck eggs having a dirty shell, nor forget that it is possible that injurious germs may penetrate through the shell of the egg, and may destroy it. The typhoid bacteria, as well as the vibriones of cholera, may enter the egg in this way, as has been experimentally proven.[1] Thus, even in such an excellent food substance death may be in hiding.

2. *Fish-roe and Caviar.*

It is really remarkable that such a useful food as that afforded by fish-eggs is not more used. I have, myself, experimented with the roe of various fishes, even some kinds seldom used. I ate this food daily for some time; and while some of the varieties really have but little taste, when fried in butter, they constitute quite an agreeable and at the same time very nourishing food. They contain much albumin and fat. According to my experience, they are also easily digested.

Fish-eggs are most frequently used in the form of caviar, as the eggs of the sturgeon are called. These fish have from

[1] After Piorkowsky, Zörkendörfer, and Wilmt.

10 to 20 kilos of roe, which is cleaned and the surrounding skin and fibers removed, and then preserved in salt. The quality of the caviar depends upon the quantity of salt used; the most expensive is the "malosol" variety, which, as the name indicates (malosol means in Russian "little salt"), contains but little of it. The color of this caviar is not black like that of the cheaper grades, but gray. The taste is very mild. It would be a most excellent food if available for most purses; as it is, a tablespoonful of the finest Astrachan caviar, as an introduction to the meal, can only be partaken of by the rich. The eggs of this variety are much larger than that of the other sorts from fish found in the Elbe River. As far as nourishment is concerned, the poorer qualities of caviar are quite good, and, like fish-roes in general, deserve much more appreciation as a food of great nutritive value. According to König,[1] caviar contains 30 per cent. of nitrogenous substance and 16 per cent. fat in its natural state; also 6 per cent. common salt. As has already been said, such large amounts of salt are not good, especially in cases where the kidneys are affected.

The above proportion of salt only occurs usually in the Astrachan caviar; the other varieties contain even more. Niebel says that the caviar made from the Elbe fishes contains from 9 to 11 per cent. of common salt.

It is therefore unfortunate that the great nutritive value of caviar cannot be made use of, for when we eat enough to derive nourishment from it we at the same time absorb much of the injurious common salt. We are thus forced to content ourselves with fresh fish-roes as a nourishing food. Caviar, on the other hand, may be taken in small quantities to stimulate the appetite. It does this very energetically, and induces a good flow of digestive fluids. I find, however, that only the "malosol" caviar is easily digested.

A fact which makes fish-eggs even more valuable for us is

[1] König: ii, 572.

their content of most valuable nutrients for the brain and nervous system. Gobler states that the eggs of the carp contain 3.04 per cent. of lecithin and 0.2 per cent. of cerebrin. In order that caviar may not have an injurious effect, it should only be taken when it does not taste sour or too salty, and when it has no odor.

(*e*) MILK DIET.

1. *Milk and its Importance.*

That which principally characterizes milk as a food, and places it above other nutritive substances, is the fact that it contains all of the main nutrient groups, thus rendering it a complete food. This is proven by the fact that young animals, and young children, too, live upon it and are developed by means of it. It is, to be sure, necessary for the proper development of the young animals, and of nursing children, that the milk should be taken in the condition in which it occurs in the mammary glands of the corresponding species. Development is sometimes furthered by milk of a foreign nature, but the latter is not to be compared with mother's milk. Bamberg has recently experimented, in the children's clinic at the Charité in Berlin, with germ-free, raw, foreign milk, in comparison with cooked, foreign, germ-free milk. The children fed upon the raw milk thrived well, but the best results were obtained when they were nourished in the natural way. A series of other experiments have also proven that animals as well as man thrive and develop much better upon the maternal milk.

It is sometimes impossible to give the milk of the mother or of a wet-nurse, and it then becomes necessary to resort to the milk of animals. That most used, as is well known, is cows' milk, which, while it contains very valuable nutritive substances and mineral salts, nevertheless differs greatly from human milk. That which most nearly approaches it is the milk of the ass, and the next is mares' milk.

Cows' milk contains on an average 35 to 40 grams of nitrogen substances per liter, together with 40 to 45 grams of milk-sugar and from 40 to 50 grams of fat. This will show what a valuable nutritive food milk is, for when only 1 liter of milk is taken in a day about 600 to 650 calories are taken, thus about one-fourth of the total amount of nourishment required per day. When 4 to 5 liters are taken in one day all the nourishment required will be furnished—for a certain length of time—as may be seen in the various milk cures resorted to for diabetes, gout, fatty degeneration, or heart affections. It is to be remembered, however, that in order to do well on a milk diet it is necessary to take a rather larger quantity of milk than that corresponding to the required number of calories, because milk taken alone is not so well assimilated, owing to the fact that the flow of saliva and digestive fluids is not greatly stimulated by it. But little saliva is mixed with the milk, and consequently the carbohydrate content is poorly digested. Madinaveitia therefore recommends that when taking milk it should be kept in the mouth for a little while before swallowing it, and rolled about as much as possible, so that the saliva will be secreted, which will make the milk more digestible. While milk taken alone is poorly digested and assimilated, this can be remedied by taking some bread or cheese with it, as has been shown by Rubner.

He found in one case that 8.3 per cent. of the nitrogen, 6.4 per cent. of the fat, and 41.1 per cent. of the nutrient salts contained in the milk were not assimilated; in another case 7 per cent. of the nitrogen, 7 per cent. of the fat content, and 24.1 per cent. of the salts were eliminated unused. When cheese was then taken with the milk, only 3.8 per cent. of the nitrogen, 7.1 per cent. of the fat, and 37.5 per cent. of the salts were lost. We see from the above how very poorly the nutrient salts in milk are assimilated.[1] The digestibility and assimila-

[1] Rubner: Zeitschrift für Biologie, 1879, S. 115; 1880, S. 119, and 1897, S. 57.

tion of milk depend to a certain degree upon whether it is taken raw or cooked. As a general thing, it may be said that raw milk is better digested and assimilated. Jessen[1] showed that 600 c.c. of raw milk remained three and one-half hours in the stomach; skimmed milk, the same length of time. Sour milk was better digested, for it only remained three hours in the stomach. That most poorly digested was cooked milk, which remained the longest time (four hours) in the stomach. This goes to show that sour milk and buttermilk are best digested.

According to Listow, sterilized milk is more poorly assimilated than raw milk. He also found that milk is better digested when bread is taken with it.

The assimilation of milk is better accomplished in children than in adults. This is shown by the experiments of Rubner and Heuber.[2]

According to Praunitz, milk is more poorly assimilated in the intestine in adults than other animal foods. At all events, we can certainly say that meat is much better assimilated in the intestine than milk. The following table shows the assimilability of the various kinds of milk and milk products, together with their composition, according to J. König[3] :—

Kinds of Milk.	Composition.			Proportion assimilated.		
	Protein. Per cent.	Fat. Per cent.	Sugar. Per cent.	Protein. Per cent.	Fat. Per cent.	Sugar. Per cent.
Cows' milk	3.39	3.68	4.94	3.19	3.49	4.84
Goats' milk	3.76	4.07	4.64	3.53	3.87	4.55
Sheep's milk	5.15	6.18	4.17	4.89	5.87	4.05
Asses' milk	1.85	1.37	6.19	1.79	1.30	6.01
Butter	0.86	83.70	0.80	0.55	81.19	0.49
Fatty cheese	26.21	29.50	3.39	24.90	26.58	3.32
Lean cheese	35.59	12.35	4.22	31.81	11.11	4.14

[1] Jessen: Zeitschrift für Biologie, Bd. 19, S. 129, 1883, cited after Hutchison.

[2] Rubner and Heuber: Zeitschrift für Biologie, 1898, xxxvi, i.

[3] J. König: "Chemie der Nahrungsmittel," ii, S. 1408.

The following is the nutritive value of the various kinds of milk and milk products:—

In 1 liter or kilo there are contained:—

Cows' milk	672 calories.
Goats' milk	712 calories.
Sheep's milk	943 calories.
Asses' milk	187 calories.
Butter	2473 calories.
Fat cheese	3808 calories.
Lean cheese	1875 calories.

We see from the above that of the various kinds of milk sheep's milk is the most nourishing, and that cheese of all kinds has great nutritive value. When one drinks milk and takes bread and cheese at the same time, he will be well nourished, for in this combination we have an easily digested milk diet which will be sufficiently sustaining, as is shown in the case of shepherds, who often live for some time upon such food. This diet is rich in the most important nutritive elements; in addition to large amounts of nitrogen, fat, and carbohydrates, it contains other indispensable substances. Milk contains much lecithin; woman's milk contains more of it than cows' milk. Burrow found in cows' milk 0.049 to 0.058 per cent.; in woman's milk, 0.057 to 0.060 per cent. Nerking and Haensel found in woman's milk lecithin to the amount of 0.0799 per cent., and in cows' milk between 0.04 and 0.11 per cent.; goats' milk contained the same amount as woman's milk.

Thus, it is plain that we absorb a considerable amount of lecithin when we take a quart of milk. Lecithin is said to favor the growth of young animals, and the digestion of fats is also improved by it.

In addition to its great nutritive value and lecithin content, milk possesses other advantageous properties, containing as it does such valuable salts as phosphorus and lime in con-

siderable quantities. According to J. König, Schrodt, and Fleishmann,[1] its composition is as follows:—

	Nutritive salt content of milk according to		
	König	Schrodt	Fleischmann
Potassium oxide	24.65 per cent.	25.42 per cent.	23.54 per cent.
Sodium oxide	8.18 per cent.	10.94 per cent.	11.44 per cent.
Calcium oxide	22.42 per cent.	21.45 per cent.	22.57 per cent.
Magnesium oxide	2.59 per cent.	2.54 per cent.	2.84 per cent.
Iron sesquioxide	0.29 per cent.	0.11 per cent.	0.31 per cent.
Sulphuric anhydride .	2.52 per cent.	4.11 per cent.	
Phosphoric anhydride.	26.28 per cent.	24.11 per cent.	27.68 per cent.
Chlorine	13.95 per cent.	14.60 per cent.	15.00 per cent.
	100.88 per cent.	103.28 per cent.	103.38 per cent.
Minus acid for chlorine		3.28 per cent.	3.38 per cent.
		100.00 per cent.	100.00 per cent.

We may thus observe how much phosphorus and lime is contained in milk. It is most unfortunate that, as has already been stated, the assimilation of both the organic nutritive substance and the salts is incomplete. The lime, in particular, is very imperfectly assimilated; according to Forster, as much as 75 per cent. is lost in the child. In spite of all this, milk is a food from which our bodies absorb considerable lime. In iron, on the contrary, milk is poor; unskimmed milk contains 0.31 per cent., and cream 2.84 per cent.; cream is likewise richer in phosphoric acid.

Very important substances also contained in milk, and which tend to make of it, as it were, a life-giving food, are certain ferments, which likewise help to render it more digestible. In boiled milk, these ferments are absent, thus making it a dead food in comparison with raw milk. Boiling and sterilization are unfortunately unavoidable when we are not certain of having pure, clean milk. As long as it remains in the udder of a healthy cow, the milk is certainly free from

[1] After Boettger, "Lehrbuch der Nahrungsmittelchemie," Leipzig, 1910, S. 202.

germs. Near the external orifices of the udder bacteria are found which have penetrated from the outside; therefore, that portion of the milk which is obtained first contains quite a number of these bacteria. The milking is, besides, often carried on in an uncleanly manner; more especially when the udder has not first been washed, the milk will contain a great many bacteria. These are not all of a harmless order; even the dangerous staphylococci and streptococci may be found among them. Some bacteria derived from the cow itself, as those of the mouth and hoof plague, can be transmitted to man. The transmission of tuberculosis from the cow to man is most improbable, as the milk of such cows is used with impunity. This has lately been shown by the numerous experiments made under the auspices of the Imperial Board of Health. In a large number of cases in which the milk of tuberculous cows had been taken for some time there were no injurious results; harm resulted only in a very few instances, always in individuals predisposed to tuberculosis.

The danger of contracting the disease through the agency of milk is not very great. The germs of other diseases, particularly those of typhoid fever and diphtheria, may be much more dangerous—they are often transmitted and cause actual epidemics, as I personally observed several winters ago during a stay in Copenhagen. The German Imperial Health Bureau proved infection by milk to have occurred in 51 out of 126 cases of typhoid fever during an epidemic. It is to be remembered that the typhoid germs thrive well in milk and increase rapidly in its lukewarm temperature. Heim found them living after thirty-five days, and the tubercle bacilli after fifteen days, even in sour milk.

In addition to typhoid-fever epidemics, diphtheria epidemics may also be caused, as has been stated by Power and Danger. According to Schlechtendal, at least 27 typhoid epidemics were caused from 1891 to 1901 owing to negligently

conducted dairies. The bacteria primarily find their way into the milk from dirt and unclean surroundings in general, or, again, through intentional watering of the milk. The surest way of preventing infection by milk is to have it sterilized. Even then a few germs remain, sometimes even of a dangerous character.

It is an interesting fact that, as was shown by Heim, the cholera bacilli soon die in raw milk, while in sterilized milk they remain active for ten days; the same results were reported by the Imperial Health Bureau; the diphtheria bacilli do not thrive as well in sterilized milk as in raw. Sterilization and the boiling of milk may, in general, be regarded as good precautionary measures against a possible bacterial infection, but they have the disadvantage that not only the ferments, but also certain other important substances contained in the raw milk, may be impaired. Indeed, milk contains the same immunizing agents as are present in the blood, namely, alexin and opsonin, which, together with the internal secretions of various glands, enter into the milk from the blood. It would lead me too far to go into the details of this subject here, but I would call attention to the fact that the presence of the internal secretions in milk is shown in that in children having an inherited weakness of the thyroid gland no symptoms of this condition develop as long as they are taking the maternal milk. When the nursing has ceased, these symptoms, as a rule, very soon make their appearance. The various substances mentioned pass out from the mother into the milk. Fortunately, this is not the case with alcohol.

2. *Various Kinds of Milk: that of the Sheep, Ass, Goat, and Mare.*

That sheep's milk, among all the various varieties, is the one containing the most nourishment has already been stated

in the previous chapter. It is strange, therefore, that we very rarely use this milk, especially since it does not have the unpleasant odor peculiar to goats' milk, and also since about 5 to 6 liters of milk are given daily by the milch sheep. It is only in very few regions in Europe that the sale of this milk is regularly conducted, as in the Dutch province of Friesland. The finest milch sheep are to be found here, and the sturdy Frieslanders cannot understand why sheep's milk is not used in the other portions of the kingdom so celebrated for its dairies. The author also considers this neglect as unjustifiable. Outside of Friesland, the greatest number of milch sheep are to be found in Iceland, and in the Pyrenees, the Appenines, and in Corsica. In the latter country the sale of sheep's milk exceeds that of cows' milk.

The chief characteristic of sheep's milk is the amount of fat contained in it. This can be increased by feeding with substances containing oil.

The average composition of sheep's milk is, according to König, as follows:—

Specific weight.	Water. Per cent.	Casein. Per cent.	Albumin. Per cent.	Fat. Per cent.	Milk-sugar. Per cent.	Ash. Per cent.
1035	85.99	9.17	0.98	6.18	9.17	0.9

When evaporated it contains:—

Protein.	Fat.	Milk-sugar.	Nitrogen.
31.33 per cent.	37.60 per cent.	38.84 per cent.	4.59 per cent.

The fat content is here very striking; none of the varieties of milk which are generally used contains as much. Hence, the fact that sheep's milk is principally used in making cheese.

Sheep's milk also contains quite a considerable amount of iron. The ash contains 1.01 per cent. of oxide of iron, and also 30.17 per cent. of phosphorus, 7.63 per cent. of chlorine, and 31.12 per cent. of lime.

Asses' milk is characterized by a decidedly sweet taste, and also by the fact that it is more easily digested than any

other kind of milk. Its use is therefore indicated in the case of very weak persons, and feeble children can be best brought up with it when the maternal milk fails. The fact that it so closely resembles mother's milk makes it very useful for suckling children.

The composition of asses' milk and of maternal milk is as follows:—

In the natural milk are contained:—

	Water. Per cent.	Casein. Per cent.	Albumin. Per cent.	Fat. Per cent.	Milk-sugar. Per cent.	Ash. Per cent.
Asses' milk	90.05	0.79	1.06	1.17	6.19	0.47
Average of woman's milk ..	87.78	0.80	1.21	3.74	6.37	6.30

It is quite a remarkable fact that among all animals the ass is the one whose milk most closely resembles human milk. Already in ancient times quite a number of healing properties were ascribed to asses' milk, and Nero's consort, Poppæ, when on a journey, always took along 500 asses, in order to be able to bathe in their milk.

Asses' milk is, in fact, worthy of much greater attention than it receives, and should be more frequently employed. Its rather sweet taste is not agreeable to every one, and its high price is against its general use. This could be remedied, however, by raising the animals in great numbers. Another disadvantage is the fact that this milk does not keep well and must be taken soon after it is milked. It is owing to this peculiarity that, in regions where the animals are raised for their milk supply, they are taken to the door of the consumer and are there milked. In Barcelona one sees the asses going about with covers bearing on the one side the inscription "Approved by the" and on the other side "College of Physicians."

Asses' milk contains fewer bacteria than other kinds of milk. It is also a noteworthy fact that asses are not subject to tuberculosis. Because of its great similarity with woman's milk and its digestibility it is much used, especially in France,

for the bringing up of delicate children. I am acquainted with several young people in that country who were fed with asses' milk, and who grew up in good health. In comparison with the widespread use of this milk in France, Catalonia, and southern Italy, its very limited use with us is striking. Its very high price is probably the chief reason, and this is possibly greatly owing to the fact that the ass is very capricious and obstinate and often objects to being milked. This animal, which is so greatly censured on account of its lack of intelligence, is, after all, not so stupid as it is said to be. The ass-mother is in fact not such a "donkey" as to be willing to give her milk, which is none too abundant, for the benefit of strange children, when she needs it so badly for her own young.

Goats' milk resembles that of the cow in some respects, but it contains more albumin and particularly more fat than the latter. As in the case of sheep's milk the fat content can be increased when substances containing fat and oil are included in the food. This variety of milk also deserves more attention than it receives, especially since the upkeep of a goat entails but little expense, as the animal is much less particular in regard to the quality of its food than is the cow, for instance. The smell of the milk, however, is detestable; but this objection might be overcome by keeping the bucks (whose sexual tendencies are much more pronounced than in most domestic animals) out of the stables. The greatest care must be exercised in regard to absolute cleanliness, and in this way the milk may be kept free from any objectionable odor.

According to my personal experience, while staying on the island of Capri, where this milk is much used, I found it much more digestible than cows' milk. The composition of goats' milk is on an average as follows, according to König (vol. ii, p. 653):—

Specific gravity.	Water. Per cent.	Casein. Per cent.	Albumin. Per cent.	Fat. Per cent.	Milk-sugar. Per cent.	Ash. Per cent.
1030	86.88	2.87	0.89	9.07	9.69	0.85

3. *Sour-milk Products: Sour Milk, Kefir, Koumiss, Jogurt, etc.*

When milk remains for a time in open vessels, various forms of fungi fall into it from the air; among them, also, the *Bacterium acidi lactici.* In summer especially fermentation occurs at a temperature of from 20° to 30° C. The milk-sugar may, in a greater or less quantity, be transformed into lactic acid. Owing to this acidity, the milk coagulates and, by the agency of the lactic acid, the casein is rendered more digestible, especially when, as in kefir, this action is continued for two or three days. The longer this fermentation process lasts, the more the milk-sugar is fermented. In this way the sugar content of such milk, especially of a several days' old kefir, is considerably diminished, so that it is less injurious for diabetic patients than ordinary milk, with its rather high content of sugar.

When such a fermentation process occurs in milk through the action of special bacilli, instead of those of various kinds which enter it promiscuously from the air, a series of very valuable sour-milk products can be obtained. Kefir, for instance, is formed by two kinds of bacilli, one a yeast bacillus, the *Saccharomyces mycodermia,* and the other the *Bacillus Caucasicus,* which forms yellowish-white clumps. These tiny clumps may be bought in the drug-stores. Kefir of one day's standing contains only a very small amount of alcohol, which is formed by the decomposition of milk-sugar by means of kefir yeast; on the second day there is more, and three days' old kefir contains still more. The milk is rendered much more digestible by this process. A portion of the casein is transformed into a soluble product, and the rest forms very tiny coagulated flakes. The older the kefir, the more hemialbumoses and peptones it contains. Kefir stimulates the digestion, and I have frequently obtained very good results by its use in cases

where ordinary milk was not tolerated. The best results were observed in nervous dyspeptics and neurasthenics in general, who also gained considerably in weight. According to the experiments of Gilbert and Chassevant, the kefir made from skimmed milk is more easily digested. They found that a liter of such kefir of two days' standing was digested one hour earlier than a two-day kefir made from whole milk.

The finished kefir contains, according to König, ii, p. 747, as follows:—

Water.	Total proteids.	Albumin.	Acid albuminate.	Hemialbumose.
88.86 per cent.	2.80 per cent.	0.78 per cent.	0.20 per cent.	0.18 per cent.
Peptone.	**Fat.**	**Milk-sugar.**	**Lactic acid.**	**Alcohol.**
0.03 per cent.	2.76 per cent.	2.52 per cent.	0.98 per cent.	0.98 per cent.

The koumiss prepared from mares' milk is very similar to kefir in its action, and is a beverage much liked by the Tartars and on the Steppes of the Kirgises. Already, in the time of the old Scythians, the antecedents of the Magyars, koumiss was a favorite drink, as stated by Herodotus. While in London I frequently drank koumiss made with cows' milk and the koumiss ferment in the Aylesbury Dairy, and found it very digestible, although I did not like the somewhat sweet-sour taste. Koumiss is quite expensive, and its curative properties are probably not any greater than those of kefir; in fact, its greater alcohol content might be considered a disadvantage, for, while kefir contains only 0.89 per cent. of alcohol, the quantity contained in koumiss is 1 per cent. more,—1.72 per cent. It contains 2.27 per cent. of albumin, 2.12 per cent. of fat, and 1.98 per cent. of milk-sugar. Its nutritive value is almost 100 calories less per liter than that of kefir.

The above-mentioned sour-milk products all have the property of combating the decomposition process in the intestine. When too much albumin is taken in the food, a portion of it may not be absorbed in the upper intestine. In the colon, then, where the intestinal flora is exceedingly abundant, its

action causes decomposition, and products may be formed the absorption of which would result in injurious effects in the organism. It is in this process that sour milk and the other above-named products have such a favorable action. According to the experiments of Metchnikoff, the Bulgarian sour milk, jogurt (pronounced "jort," in the Bulgarian language), possesses this action to a much greater degree. Metchnikoff is inclined to attribute the longevity of the Bulgarians, among whom many centenarians may be found, to the daily use of jogurt. This product forms one of the most infallible agents in causing a disinfection of the intestine, which action is produced by the lactic acid, as has been proven by the experiments of Leva in the Strauss Polyclinic in Berlin.

Jogurt is produced by the aid of the maja bacilli. The milk is first cooked for a long time, about two hours, so that it thickens and loses about one-fourth of its amount; it is then cooled to about 40° or 45° C. The maja is then added and it is allowed to ferment at 45° C. In about five hours the milk is coagulated. It has a very sour taste. Some of my patients do not much like it, and it is not always well tolerated, as it very frequently causes acid eructations and fermentation in the intestine; for this reason its use—as well as that of the other sour-milk products—is not indicated in cases where there is acidity of the stomach. By many persons, however, it is well tolerated, and it then forms a very beneficial and healthy food. In addition to its disinfecting property, it also has a laxative action, and is likewise a pronounced diuretic. It is unfortunate that, as I have mentioned above, it is so frequently not well borne. It should, however, always be tried whenever its use is indicated, and should only be abandoned when its absolute intolerance has been proven.

4. *Various Milk Products: Cream, Buttermilk.*

When milk is left standing the fat comes to the top, and when the milk is drunk the first portion taken tastes much better, and is also more nutritious, owing to the fatty content. The upper part of the milk contained in a bottle or in a large pan is the cream, or, as it is called in Carlsbad, the "schmetten," or "sahne." The name "obers" used in Austria fully explains itself.

The chief characteristic of cream is its great amount of fat, out of which butter is formed. Formerly the cream was obtained by leaving the milk undisturbed in a cool place, in large vessels or pans. In many sections—in Flanders, for example—it is still done in this way, as I have myself observed; and since the milk sours so easily, and also absorbs any kind of unpleasant odor, the farmers are very particular in keeping every one outside of these hallowed precincts. It is a very interesting fact that these farmers are most careful in not allowing their wives or their maids to enter while pregnant or during their menstrual period. They probably attribute some injurious influence to the changed condition of the breath, owing to the prevalence of gastric disturbances at such times. When we consider how easily a slight souring of the milk may occur, their anxiety does not seem to be unjustified. As a matter of fact, the cream obtained in this primitive way often has a slightly acid taste, and sometimes it is positively sour. It was consequently a blessing for the milk industry, when its centrifugal treatment was inaugurated. The Alpha separator invented by the Swede, Bernström, has probably proved to be the most efficacious. With this mechanical device great cleanliness is possible, and the quantity of cream and butter obtained is greatly increased. Souring of the cream is also prevented; it always remains sweet.

Cream is a food of great nutritive value, and has a very pleasant taste. It is much indulged in—in the form of whipped

cream (with 40 per cent. fat)—by the young girls in Germany. To be sure, it has the disadvantage of being very indigestible, like fats in general, and when, therefore, these young maidens indulge in their favorite tarts with whipped cream, about two hours before their evening repast, they spoil their appetites for this much more important meal, thus causing a deficit in their diet. Taken after a meal, cream is a splendid agent to promote fattening. As every one knows, it is also used in coffee, and greatly improves its taste. In the kitchen it serves as an addition to soups—thus increasing their nutritive value—to meat gravies, etc. As already mentioned, cream contains a considerable quantity of many important nutrient salts. It contains much more magnesia, and iron, in particular, than whole milk.

The portion of the milk which is left after the cream has been taken off is the skim milk, which, unfortunately, too often masquerades as whole milk. It is, to be sure, not so very poor in nutritive qualities, as it still contains the casein and the sugar content of the milk, and also some little fat, except in the case of milk which has been centrifugally treated, in which there is very little fat. This milk is very useful when it is employed in making bread, for bread is not at all rich in albumin—especially rye bread—and what there is is not well assimilated. The nutritive properties of bread are therefore much increased by the addition of milk. "Milk breads" and "dairy breads" are much used in Vienna and throughout Austria in general.

A very useful milk product is the fluid which remains after butter has been made, namely, the buttermilk. This is probably used in no country to the extent that it is in Holland. It is highly recommended by our Dutch colleagues, and not without reason, since it is particularly easy to digest. This is quite comprehensible, since the butter, containing all the fatty and indigestible component parts of the milk, has been removed. The lactic acid which is contained in buttermilk, which has not

been centrifugally separated, makes it all the more valuable, because of the properties which we have already mentioned. According to Rivet, the bacterial flora is no greater when buttermilk is used as food than is the case with maternal milk.

Buttermilk has a favorable action upon the bowels, and is also mildly diuretic. In view of the above, and when we remember that it also contains very valuable nutritive substances, we must consider it as the most healthful milk drink. According to Kirchner, its composition is as follows:—

Water	90.50 per cent.
Fat	0.85 per cent.
Proteins	3.75 per cent.
Milk-sugar, lactic acid	4.15 per cent.
Ash	0.75 per cent.

In Holland buttermilk is usually made from sour milk, and its action is consequently more beneficial than in that which is obtained centrifugally.

Buttermilk can be made at home by anyone, by simply beating or churning sweet or, preferably, sour milk. A very practical apparatus for this purpose is manufactured in various sizes in Zeist, in Holland, which can be taken along when traveling, so that one is able to prepare one's own buttermilk at any time or place.

When milk turns sour, the casein is eliminated owing to the action of the lactic acid, and the milk coagulates. This can be even better accomplished by the addition of a ferment,—rennet. The entire casein content is then eliminated in a very short time, and a light-yellow fluid remains, which, after the butter is removed, forms the whey. This is the milk fluid deprived of casein and of the greater part of its fat, so that the sugar is the only remaining nutritive substance. Since the amount of sugar varies between 4 and 5 per cent., whey is not to be recommended for diabetics. On the other hand, it may be most beneficial in the treatment of constipation, and in diseases of the stomach and intestinal canal.

In health resorts, such as Carlsbad, whey is often used to supplement the general treatment. It likewise contains a certain quantity of lactic acid, usually from 3 to 4 per cent., which adds to its beneficial effect.

According to Fleishmann, whey is composed, in the following proportions, of:—

Water	93.31 per cent.
Fat	0.10 per cent.
Albumin	0.27 per cent.
Milk-sugar and lactic acid	5.85 per cent.
Salts	0.47 per cent.

All things considered, buttermilk is preferable to whey, and, first of all, for the reason that it is more nourishing. Whey is, however, more easily digested by weak stomachs. It may also be mentioned that whey is rich in certain nutrient salts, such as calcium phosphate, of which it contains 21.04 per cent., and calcium chloride, of which the ash contains 49.94 per cent.

5. *Cheese.*

When milk is soured by any form of acid, it coagulates; the casein is eliminated and cheese is formed. Salting and ripening are not really necessary features in the making of cheese, as there are some varieties of cheese, such as the Gervais, or fresh-cream cheese, for example, in which these processes are not resorted to.

For the wholesale and rational, cleanly manufacture of cheese, rennet is used. Young animals, such as calves, goats, and lambs, have much pepsin (rennet) in the mucous membrane of their stomachs, from which it can be removed with common salt, thus forming an extract. When a small quantity of this liquid extract is added to milk which has previously been heated to about 30° or 35° C., the milk will, after a time, coagulate. The cheesy substance is then pressed and molded,

and is afterward salted. The quantity of salt added varies according to the nature of the cheese being made. The cheese is then placed in cellars and is allowed to ripen,—a species of fermentative process caused by bacterial action. The nature of the cheese depends not only upon the good quality of the milk, but also upon the kind of bacteria which are acting upon it during the ripening process. A great variety of schizomycetes, or fission fungi, as well as many yeasts and hyphomycetes, or mold fungi, are active in the transformation. In many of the Dutch cheeses, such as Gouda, Limburger, etc., there is no yeast. During the fermentation process gases are developed, especially carbonic acid gas, and when they disappear holes in the cheese remain. In the making of 1 kilo of cheese, 10 or more liters of milk are required.

The different varieties of cheese are produced according as sweet or sour milk, cream, or skim milk or whole milk is used, as well as according to the pressure exerted and the quantity of water which the milk still contains.

Gervais and various cream cheeses are made from cream, or whole milk and cream, and are either not pressed at all or only very slightly so. Some cheeses, as the Gervais and cream cheese, are not subjected to any ripening, or they may be ripened like the Neuchâtel, Brie, Strachino, Hagenberger, and Schwarzenberger varieties, or like the MacLaren Canadian cheese, so well known in England and America. These cheeses are distinguished by the fact that they contain a great deal of fat, which exceeds the quantity of albumin.

Soft cheeses made from whole milk—the fatty cheeses so greatly used by us, namely the Brimsen, Liptauer, and Siebenbürger varieties—are all made from sheep's milk.

Hard cheeses are subjected to heavy pressure, and in their preparation the milk is first cooked. From fat-containing milk the Emmenthaler, Edam, Chedder, and Chester cheeses are made; the Roquefort, another rich cheese, is made from sheep's

milk. From semifat milk—the whole milk of the morning milking and the skimmed evening milk—Gruyère and Parmesan cheeses are made.

The varieties containing the least fat are the Danish export cheese, the Swedish kümmel cheese, and those made from sour milk or buttermilk, such as the Mainz hand cheese, Topfen, and Quargeln, and the cheeses made from whey.

We shall now give a table of the various cheeses and their composition according to Hutchison[1] :—

	Water. Per cent.	Proteids. Per cent.	Fat. Per cent.	Ash. Per cent.
Brie	40.7	32.9	31.0	4.5
Carembert	48.6	21.0	21.7	4.4
Chedder	31.9	31.4	26.8	3.9
Cream cheese	37.0	8.6	35.9	1.5
Dutch cheese	32.9	30.8	17.8	6.7
Gruyère	39.1	31.5	28.2	4.0
Parmesan	30.0	43.8	16.5	5.9
Roquefort	25.1	39.8	31.5	5.5
Stilton	27.6	23.9	18.9	3.1

Nutrient Salt Content of the Swiss Cheeses.[2]

Potash.	Soda.	Lime.	Magnesia.	Iron oxide.	Phosphoric acid.	Sulphuric acid.	Silicic acid.	Chlorine.
Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
2.46	33.01	17.82	0.81	0.17	20.0	45.0	0.08	33.61

The chief characteristic of cheese as a food is that it probably possesses the highest nutritive value of any, and also offers the most albumin, exceeding in this respect meat and the most nourishing among the vegetable foods. When we remember that with 1 kilo of cheese we obtain 3808 calories we are surely justified in considering it the most nourishing food, since, moreover, it contains the three main elements of our nourishment. If an adult person takes during a day ½ kilo of rich cheese, ½ liter of milk, a large piece of white bread, and suffi-

[1] Hutchison: *Loc. cit.*, p. 144.

[2] E. Wolff, after Albu and Neuberg.

cient butter for the latter, he will have a full ration, and there is probably no mode of nourishment which is more wholesome and less injurious for the various organs of the body. Cheese, notwithstanding its great nutritive content, does not lead to the formation of uric acid, nor does it irritate the kidneys or the liver, if the kind used is not too old. Old cheese certainly does not possess the hygienic properties of fresh, soft cheese; but it is often more easily digested, its albumin content having become peptonized. It may sometimes, however, contain substances having a toxic action, as has been shown by Vaughan.

For a healthy person cheese is an easily digested food, and it is also very well assimilated. It assists in the digestion of other foods; thus, macaroni is more readily digested when a finely grated cheese, *e.g.*, Parmesan, is sprinkled over it; the same is true in the case of Indian corn (Kukuruz). While cheese is well digested by a healthy stomach, the case is quite different where this organ is weak. In such conditions it is better to forbid the use of cheese, for the fat, especially in hard cheeses, is digested with difficulty, and even the albumin is not easily acted upon by the gastric juice, since it is surrounded by fat. The fat contained in the fresh, soft varieties of cheese should, in general, be more readily digested. Fatty cheeses of the nature of Gervais may be advantageously used where there is overacidity of the stomach; but not the old cheeses, especially Edam or similar varieties. Great care must be taken that the soft cream cheeses, such as Gervais, are perfectly fresh, for rancid cheese is very apt to cause digestive disturbances. Just like fresh, unsalted butter, the unsalted cream cheese does not keep well, and must be used when quite fresh. When one has very good teeth, and thoroughly masticates the hard cheeses, they are not so hard to digest. In order to assist the digestion of cheese, it would be well to follow the advice of Robert Hutchison, viz., to take as much bicarbonate of soda as will cover the point of a knife with every quarter-pound of cheese.

Cheese may be especially valuable when it is taken in addition to a vegetable diet, since but little albumin is obtained from the latter,—a fact which may bring about dangerous results. These will be described in another portion of this work.

6. *Butter and Oleomargarine.*

Good fresh butter is the most savory and probably also the most easily tolerated of all fats. Its principal advantage over other kinds of fat is that its fat is not inclosed in cells, but consists of free globules, so that it is more easily acted upon by the digestive fluids, and more readily digested. Yet, butter is only a desirable and easily digested food when it is quite fresh and has not become at all rancid. A certain amount of free fatty acids are required in butter, for these give it taste and aroma. In large establishments it is customary to inoculate the cream with certain kinds of bacteria to cause the formation of a small quantity of acid. The best taste and the finest aroma will be found in the butter when the cows feed in meadows; in this way it also has a fine yellow color. During a journey from France into Spain at the end of the winter, while still in France, I had white butter which was the product of stable feeding; as I went farther south, the color of the butter became more yellow, and the taste was greatly improved, the cows having there been turned out into the meadows.

The manner of feeding cows greatly influences the quality and color of butter. With foods containing much chlorophyll the yellow color is obtained; unfortunately, however, this may also be artificially produced by saffron, curcuma, and yellow-turnip juice.

Butter should be kept in a cool and dark place, since light and heat affect it injuriously. Heat soon causes it to become

rancid, but when it is stored in a cool place it will keep a week or even longer. It is best, however, to eat butter as fresh as possible. When butter is subjected to a high temperature free fatty acids may be engendered, and it is consequently better to use fresh butter with one's food, instead of the browned butter which is obtained at a high temperature, since the latter may irritate the stomach by the quantity of fatty acid thus formed. Fresh butter, even when taken in considerable quantities, is readily digested by a healthy stomach, and even a weak stomach will tolerate a fair amount of it. The results are quite different, however, with a slightly rancid butter, which often has injurious effects on the digestive apparatus. Butter made from sour cream will keep longer, as about 2 per cent. of salt is added to it. Nevertheless, I do not consider the practice of salting butter as it is usually done in Holland, Scandinavia, north Germany, and everywhere in North America as healthful as the use of fresh, unsalted butter, since the increased salt content is often injurious for the kidneys. I find, also, that salted butter never tastes as good as the fresh, unsalted kind; the salt may cover certain defects in the quality of the butter, but does not prevent possible injurious effects. The great value of butter lies principally in the fact that when added to other foods it much increases their nourishing qualities. According to König, butter contains:—

Fat	87.0 per cent.
Casein	0.5 per cent.
Milk-sugar	0.5 per cent.
Water	11.7 per cent.

Thus, to absorb much fat in a digestible form, butter will be found a perfectly ideal food, and all the more so since it is likewise largely taken up or absorbed by many foods which otherwise would have but little nutritive value, and are nevertheless indispensable for us, such as green vegetables. Their taste is also greatly improved; Brussels sprouts, for instance,

certainly taste much better when butter is added. Potatoes and bread seem very dry without butter, and children find their bread and butter taken during the recess at school a most delightful food.

Butter being so sought after and so much liked by all, it is not to be wondered at that it has been imitated and artificially manufactured. While Napoleon III was devoting special attention to the army, he attempted the manufacture of an artificial butter at Mège-Mouriès; this was successfully accomplished under his orders, and was the origin of oleomargarine. This consists of a mixture of beef-fat, or in fact of any animal fat, and milk. The fat, which is principally kidney-fat, is melted or drawn out. An emulsion is then formed with milk and water, making a kind of buttery compound. If all oleomargarines were made in this way, there could be no great objection to their use. It is certainly better for the poor to eat a good oleomargarine than a very poor quality of butter. But here again the poor are defrauded, for lately the animal fat has been largely replaced by vegetable fats, which would not of itself be so bad were it not that they are often of a very inferior quality. Instead of using the finer grades of edible oils the very poorest are used, and the melted animal fat, which forms the principal constituent of oleomargarine, is mostly replaced by tallow.

Were we simply to judge a food according to its nutritive value, not much fault could be found with oleomargarine, for the nutritive value of a good quality is about the same as that of butter. While I do not disguise my dislike for oleomargarine, I may say that it is principally due to an antipathy for the imitation of a natural substance by an artificial one, which antipathy is common to all normal people. I would also call attention to the fact that the principal difference between oleomargarine and real butter lies precisely in that property which is most prized in our foods, namely, the taste. Even

when made from the very best ingredients oleomargarine never approaches butter in its taste; it does not have the same amount of free fatty acids. This peculiarity may prove an advantage in certain diseases, as, for instance, in severe diabetes, in which the fatty acids must, in so far as is possible, be eliminated from the food. In a normal person it is quite different, and the saponification of butter in the intestine is more easily accomplished than is the case with oleomargarine. When, however, the taste and fine aroma of butter are lacking, the most important characteristic of food substances in general is lost, and I, as an advocate of good butter, know that when it does not taste fresh and good I have no appetite for it and use a much smaller quantity. While experiments have shown that digestion and assimilation of oleomargarine are equally as well carried on in animals, and perhaps also in man, as with butter, I nevertheless find a great difference in the appetite with which an aromatic, pale-yellow, fresh, natural butter, such as is made in Teschen, for instance, will be taken and that with which the same person will eat a fatty and tasteless oleomargarine. If what Father Cats said three hundred years ago, in his old Dutch dialect—"wat smaekt dat voet" (what tastes good nourishes)—is true, then oleomargarine cannot be as satisfactory as butter. It has the advantage, however, of not becoming rancid, and for those who have not the means to buy butter oleomargarine is certainly a useful substance.

When we consider, however, how often the falsifiers sell artificial butter at the same price as the real, we shall welcome the fact that the government authorities require oleomargarine to be declared as such.

This, however, is only possible in the markets; in hotels and restaurants the guest does not have this certainty, and no doubt the author has during his travels frequently eaten oleomargarine instead of butter, or a butter largely mixed with oleomargarine. Supervision by the authorities in the form of

examinations of artificial foods should consequently not only be carried on in the markets, but be extended to the kitchens of hotels, etc. Of course, we do not here refer to hostelries of the best class, for every intelligent guest would surely notice whether the butter placed before him was good or not, and no sensible proprietor would imperil the reputation of his house by lowering the quality of a food product which plays such an important rôle in the preparation of the meals.

7. *Hints Concerning the Advantages of a Milk Diet, and its Practical Use.*

Milk is our most valuable food, and there is no other which affords greater service in maintaining the health of mankind. That this is the case is best proven by the fact that among those who not only attain the age of 100 years, but even exceed it, we find many who live solely upon milk, or in whose diet milk occupies a very prominent place.

That a person living chiefly upon milk may reach the normal limits of a lifetime, or even go beyond it, is not surprising when we remember that there is no form of diet which exerts so marked a protective influence upon our organs as that of milk. By virtue of the absence of a large amount of extractive substances, a food is provided for the liver and kidneys, as well as the blood-vessels, which contains as little material as possible of an irritating nature. Since no uric acid is formed by it, milk is one of the best preventives against gout. Since, with a milk diet, lactic acid is formed in considerable quantities in the intestines, the development of an injurious intestinal flora and the formation of decomposition products are prevented,—a fact which, according to Metchnikoff, is of great importance for the prolongation of life. I might add also, as has already been stated, that milk contains the secretions of the ductless glands, which, as we have shown

in our work on "Old Age Deferred," govern all the life processes, and upon the condition of which longevity depends. We not only absorb in the milk the secretion of the thyroid gland, but also the internal secretions of other organs, and, at the same time, milk provides a food by which such organs as the thyroid, the adrenals, the liver, kidneys, etc., are best protected and enabled satisfactorily to carry on their functions of detoxication. Milk can, however, only be accepted as really good when it is taken as it comes from the cow, that is, raw, and when there is certainty that it has been obtained from a healthy animal with the most stringent precautions. The cows must be kept in a thoroughly clean stable, from which the dejecta are carried off by special drainage. The milking staff should consist of healthy persons, who should put on clean white clothes for the milking and carefully wash their hands just before beginning. The udders should also previously have been washed. The process of milking could be accomplished in a still more cleanly manner if it were carried on by means of a suction apparatus operated with an air pump. After the milking the milk should at once be cooled and then be placed in sterilized bottles, as is done in the dairy of the Hagendorf domains, near Carlsbad, where the walls of the stalls are enameled and everything is conducted under the strictest hygienic precautions. Here the cows are frequently examined by veterinary physicians (this should, of course, always be the case) and the milk is only taken from cows which do not react to tuberculin.

It is necessary to keep the milk at a low temperature, as otherwise, with the milk in a lukewarm condition, the development of bacteria is facilitated, so that after one or two hours the originally small number of these organisms is increased to many thousands.

The country would certainly have many more inhabitants if the obtaining of milk were controlled by the government; the

infant mortality, especially during the summer, would thereby be reduced. When, owing to fear of the milk containing bacteria, children are fed upon pasteurized or boiled milk, they do not develop as well. That the same is true in the case of animals has been shown by the experiments of Behring. The experiments conducted by Palmer, of Chicago, who fed 700 children upon raw milk during the midsummer months and only lost 3 out of the number, are most instructive in this connection. As Monrad says, referring to the results obtained by Palmer, the history of all his cases showed that the miserable atrophied children began to live from the moment treatment with raw milk was begun. I wish to add here that lactic acid bacilli are always present in raw milk to a greater or less degree, and that they prevent the formation of large numbers of other bacteria, such as those of typhoid fever, for instance. The latter cannot develop in raw milk, which may nevertheless give rise to the disease, since the bacteria are not destroyed immediately by the lactic acid bacilli. When the milk has been boiled or sterilized, however, typhoid bacilli which have gotten into it will remain in it for months, as well as other forms of poisonous bacteria which are injurious in children and are the cause of the so greatly dreaded summer diarrhea. Barlow's disease in children has also been ascribed to the habitual use of boiled milk.

When raw milk free of all objections cannot be obtained, it is advisable to use another milk product,—buttermilk. This, to be sure, is also milk, but it contains more lactic acid and less fat; milk prepared by Soxhlet's method is likewise indicated.

It is not only milk that may contain the bacteria, but also the products obtained from it, such as cream and butter. In large establishments the butter is also pasteurized, which process is less damaging to butter than it is to milk, since the former is merely a fat-containing food, and the fat loses nothing by pasteurization except some of its taste. Butter

treated in this way never tastes as fresh and good as the natural butter, nor does it have the same aroma. The bacilli of tuberculosis and of other diseases, such as typhoid fever, have not infrequently been found in butter. Teichert found tubercle bacilli in 22 per cent. of the Posen country-made butter. In view, however, of the quantities of butter which we regularly eat, a normal person need not fear its use.

Having overcome the obstacles in the way of obtaining a milk free from bacteria, we encounter another difficulty. If we are to take large amounts of milk, we must find it agreeable to the palate, or we shall soon grow tired of it. In order to get a really good, rich, palatable milk—a food containing as much fat and nitrogen as possible—the cow must be fed with substances containing these elements. Here, as elsewhere in the field of our nutrition, the following principle holds good: In order to reap well, we must sow well. When the poor cow has been cheated by unscrupulous dealers, and swallows sawdust or shavings in admixture with her food, she has plenty of material in her stomach, but it is not of such a nature as will increase the quantity or improve the quality of the milk. A nitrogenous food such as grass or corn favors the production of more fat in the milk, which is not accomplished by the simple addition of oil to the food. Potato peelings and brandy mash give an unnatural taste to the milk. The very best and most natural method of feeding is in the open meadow: the cows eat more and give much purer and better milk. Some cattle owners dislike to lose the manure in this way, but it should be remembered that the fields themselves are fertilized while the cows are feeding. The great fertility of the plains of Canada is said to be due to the fact that for hundreds of years they were fertilized by the bisons which were grazing upon them. That flatulence and diarrhea are sometimes caused in the cows by the dewy grass does not affect the milk in any way, if care and cleanliness are exercised

so that the excreta do not contaminate it. The finest and best-tasting milk is to be found in those countries in which the cows are always in the fields, as in Holland and in England. From the fertile reclaimed swamps of Friesland the finest quality of milk and of butter is obtained. Damp countries like Holland, Denmark, and England have the finest grass and clover, and consequently furnish the best milk and butter. Much can be done to improve the quantity and quality of the grass when the ground is manured. As clover contains much potash and nitrogen the ground should be fertilized with these substances.

Even though the very purest and best milk be obtainable it may happen that its use will be interfered with, owing to difficulties from the standpoint of the consumer which will render the drinking of it impossible.

Some persons possess an antipathy to milk, which, in its ordinary form, is not well tolerated by their stomachs. This is especially noticeable in women and young girls. In such cases the milk may be diluted one-third with some alkaline mineral water, such as Biliner or Vichy-celestins. The addition of some fine flour may also render the milk more digestible and, hence, better borne. Small children, too, sometimes prefer milk given to them in this form. For those who cannot tolerate ordinary milk at all the more easily digested buttermilk may be of great service.

At all events, the milk products, such as butter and cheese, may be used in such cases. It would be a good thing for us to adopt the custom which prevails in America, of eating some butter with each meal. In the restaurants there, butter is furnished without charge, along with the other food ordered. Unfortunately the butter is always salted in America, and, while it may be preferred in this way by some, it is by no means as healthful as fresh butter.

The use of cheese after each meal at which much meat has been partaken of would be advisable; in healthy persons it would be of service in favoring the assimilation of food, and where an abundant meat diet is taken intestinal decomposition will be hindered by the use of cheese and butter.

The other advantages of a milk diet will be treated of in the chapter on the milk-vegetarian diet.

8. *Additional Note Concerning the Benefit Occasionally to be Derived from a Glass of Hot Milk.*

We have already emphasized the fact that milk should be taken raw. Circumstances may present themselves, however, when a glass of hot milk will exert a beneficial influence upon the system. This is the case, for instance, where one has been out on a damp, cold, winter's day, and comes in feeling chilled. In cold, windy weather the activity of the skin functions are greatly diminished. The various poisonous products which are usually thrown off through the skin are in consequence retained, the result being a decided feeling of discomfort.

These substances then find their way into the kidneys and exert an irritating action upon the delicate epithelia of these organs. Now, by drinking one or two glasses of hot milk, we greatly stimulate the activity of the skin. The circulation of the blood is increased, more blood flows toward the skin, and we feel much warmer. The irritating action of the substances passing through the kidneys is diminished, and when hot milk is taken, together with irritating agents in the food, their action upon the various organs, the kidneys in particular, is less intense.

In inflammatory conditions of the mucous membranes hot milk exerts a beneficial action. This is noticeable in colds, if early in the morning or on rising hot whey or hot milk is

taken together with Ems water, or Giesshübler, Krondorfer, or Biliner. Even without the addition of such waters, warm milk will exert a favorable influence upon the irritated and inflamed mucous membranes. When, for instance, in acute gonorrhea the urethral mucous membrane is extremely sensitive, almost all pain in urinating may be avoided by the previous ingestion of one or two glasses of hot milk. This is also the case in chronic gonorrhea when the urethra has been sounded; the severe pains accompanying the first passage of urine are considerably diminished after hot milk has been taken.

In the presence of inflammatory conditions of the intestines, hot milk may prove more useful than other food substances, especially if rice or sago in the form of a thin paste be taken with it.

To warm the body up on a cold, frosty day, tea is often used; but from the standpoint of health milk is better, especially where the kidneys are not absolutely normal. A small quantity of coffee or tea could, of course, be added to the milk to render it more palatable. Addition of the yolks of one or two eggs makes of milk a very strengthening drink after exhausting journeys in winter.

For patients who are ordered to take large quantities of milk, but dislike it, too, the addition of yolks of eggs may make it more palatable. In some countries, *e.g.*, in Spain, a few drops of an extract of orange flowers are added to flavor hot milk.

While hot milk exerts a very favorable influence upon the more remotely situated mucous membranes, it may occasionally injure the buccal mucosa. It is best to have it served in porcelain glasses, and, when it is too hot to drink, it can then first be poured into a cold, empty glass.

(*f*) Fats of Animal Origin.

All foods, before they are absorbed by the intestines, must first be brought into a fluid condition. This rule holds good for the fats, and it is for this reason that such fats as are not soluble and do not melt at the temperature of our bodies are digested with difficulty. Lamb-fat melts at a temperature of 45° to 55° C.; it is therefore very indigestible. Next in order in respect of digestibility comes beef-fat; its melting point is lower than that of lamb-fat, yet often exceeds 40° C. Pork-fat is rather better, but it also melts at about 40° C., and frequently even at a higher temperature. The Jews are wise in cooking with goose-fat, which has its melting point always below 40° C.; on the average it is 30° to 35° C., but sometimes it is lower than that. Goose-fat is consequently the most easily digested fat, because its melting point is the lowest of any fat of animal origin. Its taste is pleasant, and it is more healthful than pork-fat. Butter made from cows' milk is also very wholesome, and, next to goose-fat, probably melts at a lower temperature than any other. For this reason it is quite justifiable to employ butter for daily use in preparing food. It is certainly not healthful to use beef-fat (drippings) for cooking, as is done in many hotels in England. I have learned from personal experience how frequently one has eructations and acid is formed in the stomach after its use. That lamb-fat remains for a considerable time in the stomach can often be noticed after one has eaten fat lamb for dinner. Fat, in general, retards the movements of the stomach.

Fluid fat, such as fish-blubber and codliver oil, is not very indigestible, and both children and adults can tolerate quite a considerable amount of the finer varieties, although it has a much more unpleasant taste than other animal fats. It is certainly worthy of being much more generally used by weak,

delicate adults, and by persons who have been debilitated by exhausting diseases, than it is now, as it is well absorbed and assimilated. Animal fats in general are well assimilated, as has been shown in the case of milk-fats by the experiments of Tschernoff. Among the Eskimos, fish-blubber forms a large part of the diet; in common with other northern peoples, they have a great predilection for fats. In Scandinavia butter is never absent from the table, especially in Sweden, where at every meal it is thickly spread upon the Swedish graham bread —"Knäkebröd"—or upon white bread.

This preference on the part of dwellers in cold climates for fats is probably due to the necessity of a food rich in calories, *i.e.*, which will produce much heat; and fat, of all foods, is that of greatest value in this direction. Even in temperate climates the daily addition of a considerable amount of fat to the diet increases the nutritive value of the latter and improves the taste of the viands. Butter is best for this purpose, as has already been said; indeed, our food in general should be prepared with it; to vegetables, in particular, it should be freely added. Butter is far better than vegetable fats, as I have ascertained from personal experience.

Fatty foods should be ingested by persons desirous of rapidly taking on flesh, since the fat absorbed from foods, if well digested and assimilated, will speedily produce this result. Too much fat, however, should not be taken at one time, as the assimilation of other foods will suffer. That fat should be avoided by the obese is self-evident; diabetics, on the other hand, by taking fats with vegetables may derive some benefit from their use. The butter which they use should, however, be well washed out and freed of fatty acids, as otherwise rapid formation of the dreaded acetone bodies may follow. Pigs' lard and certain vegetable fats containing the least amount of fatty acids, *e.g.*, cottonseed oil (which, according to Salkowski, contains only 0.29 per cent.), would be preferable in such cases.

(*g*) Leguminous Vegetables and their Importance.

When it is desired to absorb a large amount of vegetable albumin, it is best to rely especially on the leguminous varieties. These are so rich in albumin as to be unsurpassed in this respect by any other vegetable or even animal food. The difference between the albumin contained in animal tissues and that of leguminous vegetable foods lies in the fact that meat albumin is well assimilated, whereas this is not the case with that contained in legumes, when prepared in the usual way, even if they have been cooked for a considerable time. When used in the form of a purée they are more digestible and are better assimilated, so that no great amount is passed out unused by the intestine.

The special property which renders leguminous vegetables hard to digest and to assimilate is the quantity of cellulose or woody fiber contained in them, which greatly exceeds that present in the majority of other foods. This tough, horny substance prevents the action of the intestinal fluids upon the food, and thus there is lost not only a portion of the albumin, but also of the carbohydrate material,—although not so much of the latter as of the albumin. The carbohydrate content of leguminous vegetables is quite considerable, and in some, as in the soy bean, to which we shall refer at greater length in an appendix to this chapter, there is also a large proportion of fat. In order that these nutritive elements of the leguminous vegetables should be assimilated as completely as possible, the method of preparation and cooking is, however, of great importance. In the first place they must be cooked in soft water, since their albumin, which, owing to its great similarity to casein, has been called vegetable casein or legumin, forms together with the lime, when cooked in hard water, as stated by P. F. Richter, an insoluble combination which is but poorly

assimilated. By the addition of a little bicarbonate of sodium to the water, this, however, can be avoided. According to P. F. Richter, 10.16 per cent. of the nitrogen and 19 per cent. of the nutrient salts are not assimilated from peas which have been boiled in soft water; from those cooked in hard water the nitrogen loss amounts to 16.60 per cent. and that of the nutrient salts to 42.22 per cent.

The most advantageous mode of preparing leguminous vegetables is in the form of a purée, as by this method the greater part of the cellulose which interferes with digestion and assimilation is removed. The high albumin content of these vegetables is best utilized if, after the husks have been removed, the rest is ground to a fine powder and then mixed with some other flour less rich in albumin, *e.g.*, rye flour. From this a bread is made which is much richer in albumin than that made from ordinary flour, and which well deserves the name of "Kraftbrot" (strength bread). The most nutritive of these breads is undoubtedly the soy bread, on account of the higher percentage of fat and, especially, the exceptionally large amount of albumin it contains.

After the foregoing introductory remarks concerning the value of leguminous vegetables, we shall now present an analysis of the varieties most used when in a ripe, full-grown condition; fresh, green vegetables will be further referred to in a succeeding chapter. In addition to the percentages of the various nutritive elements, which we quote from König,[1] we shall also indicate what proportion of these substances is assimilated:—

[1] König, ii, p. 1488.

PROPORTION OF SUBSTANCES ASSIMILATED.

Leguminous vegetables.	Nitrogen content. Per cent.	Fat content. Per cent.	Carbohydrates. Per cent.	Cellulose. Per cent.	Nitrogen assimilated. Per cent.	Fat assimilated. Per cent.	Carbohydrate assimilated. Per cent.	Calories. Per kilo.
Peas	21.35	1.88	52.65	5.56	16.98	0.60	45.85	27.16
Lentils	25.94	1.93	52.84	3.92	18.16	0.58	44.65	27.18
Garden beans	23.66	1.96	55.60	3.89	16.56	0.59	46.98	27.39
Field beans	25.68	1.68	47.29	8.25				

In addition to this exceedingly rich and valuable nutritive content of the leguminous vegetables, there are also present in them quite considerable amounts of important nutritive salts—above all, a great deal of potash and phosphorus, and, in comparison with other vegetables, also much lime. Of the latter they contain more than the cereals and many other vegetable products.

The nutritive salt content of the vegetables already referred to is, according to König,[1] as follows:—

NUTRITIVE SALT CONTENT OF THE PRINCIPAL LEGUMES.

	Potash. Per cent.	Soda. Per cent.	Lime. Per cent.	Magnesia. Per cent.	Oxide of iron. Per cent.	Phosphorus. Per cent.	Sulphuric acid. Per cent.	Silicic acid. Per cent.	Chlorine. Per cent.
Peas	41.89	0.96	4.99	7.96	0.86	36.43	3.49	0.86	1.59
Lentils	34.76	13.50	6.34	2.47	2.00	36.30	....	....	4.69
Garden beans	44.01	1.49	6.38	7.62	0.32	35.52	4.15	0.57	0.86
Field beans	41.48	1.06	4.99	7.15	0.46	38.86	3.39	0.65	1.78

We find in the above a pretty high content of phosphorus—although the cereals contain more of it—and of phosphoric acid, which manifests itself in the acid condition of the urine; the leguminous vegetables therefore share this property with meat; this applies also to their considerable nitrogen content.

[1] König, ii, p. 784.

The sulphur contained in certain leguminous vegetables, such as beans, is responsible for the flatulency caused by them. It is also important to note that these vegetables contain much lecithin—1 per cent. As far as the digestibility is concerned, we see from the above table that the albumin contained in peas is best assimilated. This is due to the fact that peas are eaten without their shells. Green peas are best digested and assimilated, as we shall show elsewhere. They are also most frequently used, for when peas are quite ripe and old they are very hard to digest and assimilate, but are nevertheless better in this respect than beans or lentils under similar conditions. According to Rubner, when large quantities of peas are eaten, 14.5 per cent. of the dry substance, 27.8 per cent. of the nitrogen, 75 per cent. of the fat, 6.9 per cent. of carbohydrate, and the large amount of 3.5 per cent. of the nutrient salts are eliminated unused. Peas are much better assimilated when taken in small quantities, when only 17.5 per cent. of the nitrogen is lost. The best assimilation takes place when peas are eaten in the form of a purée; in this way they are assimilated about as are fine wheat flour and macaroni.

We have already mentioned that leguminous vegetables contain considerable lecithin—more than the cereals. Peas contain 1.05 per cent.; other substances found in peas, namely, the purin bases, have, however, an injurious action, since they increase the formation of uric acid. According to Walter Hall and the latest experiments of Bessau and Schmidt, they contain quite considerable amounts of these substances, but, nevertheless, not so much as do lentils; peas contain 0.018 gram in 100 grams, while the lentils, which, among the legumes, have the greatest quantity of purin, contain 5 cg. in 100 grams.

The best way to eat full-grown peas is in a purée, and they are usually prepared in this manner. In some countries, as in Spain, for instance, large dried peas, of a variety common in that country, are a universal and greatly liked food, and

these "Garbanzos" form, as I have seen, a daily addition to the diet, both there and in Mexico. They may, in a measure, be responsible for the obesity which so frequently affects the women of these countries. The purée form is decidedly preferable, but it has the disadvantage of being merely swallowed, with but little, if any, mastication. With such a purée something hard should be eaten, as, for instance, a piece of rye bread; in this way it would require mastication and would then be better digested.

Purée of peas is rendered very nourishing when bacon or sausage is taken with it. This food is often given to the German soldier, who thus receives a truly nourishing diet, containing all three of the main groups of our foods, and for a soldiers' stomach it is not very hard to digest. Some people declare that the German army has accomplished its able work not only because of the efficient German instructors, but also because of the "Erbstwurst" (pea sausage), and it is certainly true that a sufficiently rich and complete food, such as this sausage, plays an important rôle—in reality much more important than is generally believed—in making an army capable of marching and of successful action. In pea sausage there is not very much meat, but the carbohydrates, vegetable albumin, and fat are all well represented.

Lentils are also a valuable food. Since, however, according to Strümpel, they are but poorly assimilated after having been soaked and then cooked,—nearly 40 per cent., thus pretty nearly the half, of the albumin content being lost,—they, too, are best taken in the form of purée. They are then well assimilated, as was found by Strümpel, and only 9 per cent. is lost. I also observed that when boiled lentils were eaten in considerable quantities the undigested skins were present in the stools.

That which makes lentils so nourishing is the rather large proportion of iron contained in them, particularly in the

Egyptian lentils, which are the best variety. It is not only among leguminous vegetables, but among other foods as well, that lentils occupy a first position in regard to the iron content. When finely ground, they form a most valuable food, the "Revalenta arabica," which, as stated by Hutchison, contains 22 per cent. of easily digested and assimilated albumin, 1.5 per cent. of fat, and 65.2 per cent. of carbohydrates. Owing to their limited sulphur content, lentils cause but little flatulence, and in the form of purée are really a food deserving of much more attention than is at present accorded to it. That lentils are so neglected as never to be included in the bill of fare in the best restaurants, notwithstanding their agreeable taste, is one of the incomprehensible anomalies too often met with in the present-day scheme of nourishment.

Another leguminous vegetable, the bean, almost as healthful as the lentil, is, on the contrary, very much used. Probably in no country in the world are beans more used than in the United States, as in the form of "Boston baked beans." One finds them in all the restaurants and buffet cars in the Union cooked with bacon, as "pork and beans." The experiments of Praussnitz show that the ripe white beans are poorly assimilated, even more so than other legumes, and this not only as regards the albumin, but the carbohydrates as well, of which 17.5 per cent. are unused. Beans, too, are better digested in the purée form. A thick bean purée soup tastes very good and is easily digested. Whole beans as well as lentils often pass through the intestinal canal undigested (Praussnitz). Beans as an article of diet have the great disadvantage of causing decided flatulency; there is hardly any other food either among the legumes or other varieties of food which causes this to such a marked degree. It is probably due to the large amount of cellulose and of sulphur contained in them. In fact, the disadvantage of inducing flatulency to a greater or less degree is common to all leguminous vegetables, and they have the

additional drawback of causing acid eructations, to a much greater extent than many other foods, in persons who are predisposed to this condition; this is especially the case in nervous affections. Since they impose more work upon both the stomach and intestines, also causing more flatulency, than the majority of foods, leguminous vegetables should be strictly forbidden in stomach and intestinal diseases as well as in arteriosclerosis. Neither should they be allowed for persons suffering from gout, since they contain a considerable amount of purin bases, which favor the formation of uric acid; lentils contain the most, peas come next, and lastly beans. Persons who fear to grow stout should eat but little of the leguminous vegetables, and the same may be said of diabetics. For the latter it is best, according to my experiments lately cited, to eat these leguminous vegetables whole, that is to say, with their skins, since they are not so well assimilated in this way, and consequently do not greatly increase the sugar secretion in mild cases of diabetes. These vegetables should form the principal portion of a vegetarian diet, as they alone contain albumin, that important nutrient, in appreciable quantities. For healthy persons the leguminous vegetables form the best vegetable diet.

Addendum. Special Advantages of the Soy Bean.

This vegetable, which grows in China, principally in the province of Manchuria, is really a curiosity among vegetable foods; and since it is so very rich in various component parts of the main food groups, we are probably not going too far in calling it the most valuable plant we know of. Leguminous vegetables and cereals are rich in albumin and carbohydrates, but the soy bean not only contains these substances, but also another most valuable foodstuff, in which it far exceeds both the leguminous vegetables and cereals, namely, a large amount

of fat. The albumin content of the soy bean is from 27 to 33 per cent., the carbohydrates amount to between 10 to 35 per cent., and the fat content from 17 to 22 per cent. This is indeed a combination scarcely to be found in any other plant, and the nutritive value in the completeness of its composition surpasses the most valuable animal foods. Since it contains all three of our principal food groups, it plays much the same rôle as milk, while exceeding the latter in its wealth of nutritive substances. However, the soy bean offers the objection that when eaten whole nearly 5 per cent. is lost in the intestines, owing to the cellulose which it contains. This objection is done away with when it is eaten in purée form, or as a fine flour. Its great value in nutritive substances—fat, in particular—as compared to the flour made from other vegetables will be seen in the following table: Nutritive value of various flours made from vegetables[1] :—

NATURAL SUBSTANCE.

	Nitrogen content. Per cent.	Fat. Per cent.	Carbohydrates. Per cent.	Raw fibers. Per cent.
Bean flour	23.23	1.19	59.92	1.78
Pea flour	25.72	1.78	57.18	1.26
Lentil flour	25.71	1.86	56.79	
Soy-bean flour	75.69	18.83		

On the other hand, the soy-bean flour is much poorer in carbohydrates, according to an analysis in the Laboratoire Municipal of Paris: 16.32 per cent. Owing to this property, von Noorden and Lampé manufactured a food for diabetics from the soy bean, called sarton, which, while containing very little carbohydrate, has a large amount of albumin. According to an analysis by Lecerf,[2] soy-bean flour only contains 2.794

[1] After König, ii, p. 815.

[2] After Gautier.

per cent. of starchy substance. Another advantage of the soy bean is its large amount of phosphorus and lecithin. Of the valuable lecithin, it contains 1.64 per cent.,[1] a quantity which is not reached by any other plant, with the exception of the lupines.

All leguminous vegetables are rich in lecithin, especially lentils, but in this respect the palm must be accorded to the soy bean. It likewise exceeds the other leguminous vegetables and many other plants as well in its phosphorus content. As I see in the recently published "Dissertation on the Phosphorus Content of Various Indian Foods," by Jebbink,[2] the Dutch East Indian "Katjang Kedelen," a variety of soy bean, contains 1.19 per cent. of phosphoric acid.

This wonderful vegetable, in addition to its valuable contents, has the further advantage that it can be used in so many useful foods. We have already referred to the flour made from the soy bean. From this, when mixed with white flour or any other desired sort, a bread can be made with such a high albumin content as is hardly otherwise possible; biscuits can also be made from the soy-bean flour which are very valuable for diabetics, because of the low carbohydrate content. The products made with this flour have an agreeable taste, somewhat resembling that of the chestnut. A kind of milk can also be extracted from soy beans, if they are allowed to lie in water for several hours and are then mashed or pressed out. And just as with any other milk, a cheese can be made which is very nourishing. Through fermentative action valuable nutritive products can be made from the bean: the To-fu cheese is most nutritious, and a sauce, "soy sauce," is also made from it, which looks exactly like meat extract, and, in my opinion, also tastes much like it. I found it a pleasant addition to other viands, and it is no doubt free from the injurious effects of the

[1] König, ii, p. 87.
[2] Jebbink: *Loc. cit.*, p. 83.

genuine meat extract. An oil can also be made from the soy bean, and in Manchuria one sees in all the cities and many smaller towns such oil mills. They are, to be sure, of rather primitive construction, but serve to provide the Chinese of these regions with the fat so much in demand. A substance resembling butter, a thick cream, can be made from this wonderful bean; it tastes much like "Maroni crême." And lastly I must not forget to mention that when the beans are allowed to sprout under glass the sprouts do good service as a green vegetable. I tried to eat these sprouts raw, and found them quite palatable. I might also mention that a kind of macaroni is made from the soy bean, and Wein[1] states that a very good tasting soup can be made with these beans together with peas. They may also be cooked together with other vegetables, as potatoes and rice. A purée on the order of the Italian "polenta" can likewise be made. When the whole beans are eaten they are poorly assimilated, and, according to Osawa, 37.4 per cent. of the albumin is lost, while when eaten in the form of To-fu only 3.9 per cent. is lost.

It would certainly be well to transplant these wonderful beans into Europe; they much resemble our beans, but are somewhat more round. There are yellow, green, black, and several other varieties. Attempts were made in France to plant this bean, but unfortunately when it becomes acclimatized in Europe it has a tendency to graft itself upon our native bean, and thereby loses its own properties. This might perhaps, in my opinion, be obviated by proper fertilization, for, while in Chinese soil the nutritive content of these beans is much greater, the cause probably lies in the fact that this soil, as has been shown by examinations recently made at Erfurt, is much richer in nutritive substances and salts—particularly phosphorus—than ours. It would therefore be necessary to ferti-

[1] After König.

lize according to the composition of this plant, with a considerable amount of nitrogen and phosphates.

(*h*) Cereals.

1. *The Various Cereals.*

If we class these fruits of the earth, to which we owe our daily bread, after the leguminous vegetables, it is because we wish to give the preference to those plants which furnish us with the greatest amount of the most nourishing substance, namely, albumin. This occurs in smaller quantities in the cereals. They, on the other hand, furnish a nutritive element, the carbohydrate, which is only second in importance to albumin. Rice, for instance, contains more of the carbohydrates than any other food. The nutritive value of the cereals is consequently characterized by a large amount of carbohydrates and a fair quantity of albumin; the latter occurs principally in wheat and oats. The third important component of our food, fat, is very poorly represented in them, and least of all in rice; corn and oats considerably more. The cereals are also rich in some of our most important nutritive salts, namely, phosphorus. Since we have previously given the quantities of the most important nutrient salts contained in each of the cereals, we shall now first give the chemical composition of the foodstuffs according to Robert Hutchison:—

Cereal varieties.	Nitrogen content. Per cent.	Fat. Per cent.	Carbohydrate. Per cent.	Cellulose. Per cent.
Wheat	11.0	1.7	71.2	2.2
Oats	10.9	4.5	59.1	12.0
Barley	10.1	1.9	68.6	3.8
Rye	10.2	2.3	69.5	2.1
Corn	9.7	9.7	72.3	2.0
Rice, polished	0.9	0.4	76.8	0.4
Millet	10.4	3.9	68.3	2.9
Buckwheat	10.22	2.2	61.3	11.1

It is unfortunately the case that in the majority of these cereals much of the nutritive substance is lost to our bodies—that is to say, it is not taken up by the blood—before it can be freed from the outer indigestible portions. In this way not only a large amount of the nutritive albumin is not assimilated, but many nutrient salts, such as phosphorus, lime, and iron, are also lost.

The finer the flour is ground, especially wheat flour, the more of the nutritive substances are lost. Some cereals, such as millet, barley, and buckwheat, are very poorly assimilated by us, and consequently flour made from them is not much used in our country. We here show, according to König,[1] the composition of various kinds of flour:—

	Proteids. Per cent.	Fat. Per cent.	Carbohydrate. Per cent.	Cellulose. Per cent.	Ash. Per cent.
Fine wheat flour........	10.68	1.13	74.69	0.30	0.52
Rye flour...............	9.62	1.44	73.84	1.35	1.17
Oat flour...............	13.87	6.18	67.06	1.71	2.07
Corn meal..............	9.62	3.14	71.70	1.41	1.14
Barley flour	12.29	2.44	69.47	0.89	1.85
Buckwheat flour........	8.28	1.49	74.58	0.70	1.11

Of these various flours, wheat flour is most useed. A very fine quality of wheat flour comes from Hungary (especially from Banat) and the southern part of Russia. The very finest and best wheat is, however, grown in Canada, where, in the province of Quebec, I saw an almost unbelievable development of the ears and grains in corn and other cereals. The province of Manitoba furnishes a still finer quality. In this virgin soil, until recently entirely uncultivated, which still contains all of the nutritive salts, wheat is grown such as is found nowhere else. The value of wheat is determined principally by its albumin content, that is to say, the gluten; in this respect the Hungarian wheat is the finest, and I have never tasted better

[1] König, i, p. 625.

wheat bread than in Hungary, and perhaps in the northern part of the United States, in Minneapolis, where there are steam flour mills on the order of those in Hungary. It is not the fact of its being so finely ground which makes the Hungarian meal so agreeable to the taste, but rather its rich content of gluten, salts, and other elements of taste.

According to Rubner,[1] the percentage of nutritive salts in the dry substance of wheat is as follows:—

Potash.	Soda.	Lime.	Magnesia.	Iron oxide.	Phosphoric acid.	Chlorine.
0.62	0.06	0.065	0.24	0.026	0.94	—

Thus, considerable amounts of certain salts, especially phosphorus and lime, are found in wheat, but unfortunately they occur principally in the outer portion of the grain, which also contains the greater part of the glutinous substance,—the starchy substance is contained in the inner portion,—and in the finer qualities of flour the outer portion of the grain is lost. The more gluten there is in wheat flour, the greater its lime and phosphorus content. In very fine flour many valuable substances—especially albumin and nutrient salts—are lost in the bran. According to Rubner, 100 parts of

Dry wheat flour contains:—	Wheat bran contains:—
11.6 per cent. albumin	13.9 per cent. albumin
1.3 per cent. fat	3.1 per cent. fat
86.4 per cent. starch	81.9 per cent. starch

While wheat flour thus contains an appreciable amount of bran, much of this is not taken up by the blood, but is eliminated unused. Rubner found that wheat bread is very poorly absorbed, and that much more albumin and carbohydrate are lost when much of the bran is ground in with the flour. Fortunately not all of the bran content is lost, as 61.3 per cent. of albumin and 26.5 per cent. of carbohydrate and cellulose are nevertheless absorbed. It is of great importance that the bran

[1] Rubner: "Lehrbuch der Hygiene," 8th edition, p. 465.

be finely milled, and that the stomach and intestines be in good condition.

Rubner's statement, that the German people would gain a yearly profit of 780 million of marks if bran could be as well assimilated by our bodies as flour, is most interesting.

He estimates that in the very best mills 20 per cent. is lost as bran. If it were possible to grind this bran finer than it is now done, it could be better absorbed, and would be of great value to mankind. With wheat flour it is therefore of primary importance that it be finely ground, and fine bread is much better assimilated in general than the coarser varieties. The coarser flour would, however, be better assimilated if milk, or, still better, cheese, were to be taken with the bread.

Rye flour, when it contains the bran, is very badly assimilated, according to Romney, however finely it may be ground. Rubner states that bread made from fine rye meal is assimilated about as very coarse white bread would be. The nutrient substances in the outer covering of corn are not only very poorly assimilated, but, by irritating the intestinal canal, they also cause a too early elimination of other useful substances, before they can be absorbed by the intestine. Coarsely ground corn, owing to the cellulose it contains, has a very irritating effect upon the intestinal mucous membrane, which might be an advantage in cases of constipation; in healthy persons, however, the use of much corn bread would cause too frequent bowel movements, and interfere with the assimilation of the food. Rye flour is best suited for strong constitutions, and by the sturdy northern races it is more used than wheat flour. While wheat is principally used for the finer varieties of breadstuffs consumed by the rich, rye flour forms the food of the poorer population. It is not deficient in nutrient salts such as iron and lime. Unfortunately the assimilation of the salts and other nutritive substances is very defective, according to Rubner, who states that in whole-corn bread only one-half of the nutritive value is absorbed.

Oats, which are used in the north, principally in Scotland, and which contain more cellulose than any other cereal, are even more poorly assimilated. When oats are to be used, it is best to eat the products manufactured especially with a view to the digestibility, like oat flakes, Quaker oats, etc.; in these by the action of heat the very indigestible cellulose husk or outer skin is burst open, and the starchy content is converted into a soluble and more digestible product. Oats in the form of gruel (like the porridge of Scotland) are very palatable when eaten with cream, and certainly I have never eaten better porridge than that served to me in Edinburgh, where I also acquired a taste for zwieback made from oats (oat cakes). Of course, I experienced the disadvantage that when porridge was swallowed too quickly—and was consequently not masticated—digestion and assimilation suffered. With oat cakes this difficulty is obviated, as they, like other oat breads, require considerable mastication.

In my estimation a purée of oatmeal with two yolks forms a very healthful food, in which the eggs not only greatly improve the taste, but also increase the nutritive value. Very valuable preparations for children's use can be made with oatmeal, which render good service when taken with milk. In my practice in Carlsbad I obtained excellent results with oat flakes and oat gruel. The composition of both, according to König, is as follows:—

	Proteids. Per cent.	Fat. Per cent.	Sugar. Per cent.	Carbohydrate. Per cent.
Oat gruel	13.44	about 6	2.16	61.72
Oat flakes	14.42	6.78	1.40	62.58

As by their use the irritating action of the cellulose is avoided, they form valuable foods, since, as can be seen in the above table, they contain a considerable amount of albumin and fat. Oatmeal is likewise not lacking in nutrient salts, as it

contains, according to König, 7.92 per cent. lime, 0.85 per cent. iron oxide, 48.19 per cent. phosphoric acid, 1.95 per cent. silicic acid, and 5.93 per cent. chlorine.

Oats (whole) contain, as stated by König,[1] the following percentage of nutrient salts:—

Potash.	Soda.	Lime.	Iron oxide.	Phosphoric acid.	Silicic acid.	Chlorine.
17.90	—	3.60	1.18	25.64	30.18	0.94

The considerable lecithin content of oats is also noteworthy. Topler found that 11.90 per cent. of lecithin is contained in oat fat. We thus see what a valuable food oats furnish, particularly when taken with milk, in which manner they are better assimilated. Oats should be much more frequently used, especially in the form of oatmeal and oat gruel, than has been customary. Not only the horse, but man also, would thrive upon it. A very valuable statement is that of von Noorden, that diabetics can take considerable quantities of oat foods in combination with other vegetables without causing any increase in the sugar secretion; it is, on the contrary, often diminished, as is also the case in acetonuria.

Another very little used variety of cereal—barley—might be rendered very valuable for us, if specially prepared by heat in the form of barley flakes. In Sweden barley is often made into bread. It is, however, very indigestible when whole barley is ground, as was found by Osawa, for of the albumin content 56 per cent. was eliminated unused, this being the case even with barley that had been ground and cooked. With us it is principally used in soup, as barley cream, gruel, etc. Barley water has long been used as a cooling drink in fevers. Barley plays its principal rôle with us when used in coloring beer. The American variety has more sugar and less dextrin, and the German less sugar and half as much again of dextrin. The ash of the dry substance contains the following nutritive salts, as stated by König:—

[1] König, ii, p. 773.

Potash. Per ct.	Soda. Per ct.	Lime. Per ct.	Magnesia. Per ct.	Iron oxide. Per ct.	Phosphoric acid. Per ct.	Silicic acid. Per ct.	Sulphuric acid. Per ct.	Chlorine. Per ct.
21	2.39	2.64	8.83	1.19	33.10	26	1.80	1.02

Buckwheat is also very little used with us (in Austria); its large amount of cellulose makes it very indigestible, and it is badly assimilated. It could be made a valuable food if previously prepared by the removal of the cellulose, as is the case with the Knorr buckwheat. It would be valuable for the preparation of bread and pastry for diabetics. The ash contains appreciable quantities of nutrient salts, 1.74 per cent. iron oxide, 48.67 per cent. phosphoric acid, 3.07 per cent. of potash; the soda content is comparatively high, 6.12 per cent., and there is also 1.30 per cent. of common salt. Buckwheat flour is of a dark color; in some countries it is used for making bread. In Styria and in the adjoining portions of Hungary, dumplings called "Nocklen" and "Sterz" are made from a mixture of this and other kinds of flour; they form an appetizing article of diet, which is sometimes also used in intestinal catarrh.

The cereal least used in our country is millet; it is, however, the national food, so to speak, of many negro tribes. Notwithstanding the considerable amount of cellulose—according to König, 12 to 18 per cent.—it is not unpleasant as a food; 53 per cent. of the nitrogen content is lost. When it is taken in the form of a pap or gruel with milk or water, with a little butter or even lard added, I have found that it tastes quite good. As it contains valuable nutritive substances, it should find greater appreciation among our poorer classes than is the case at present. Its deficient assimilation can be allowed for by taking more of it. Of the three cereals, barley, buckwheat, and millet, buckwheat is best assimilated.

2. *Concerning Foods made with Flour, and Noodles. The Useful Properties of Macaroni and of Certain Kinds of Pancakes.*

The principal varieties of flour above mentioned, and particularly fine wheat meal, can be made to serve as very useful foods by preparation into a dough with the addition of water, salt, and a small quantity of potato, preferably as potato flour. The so-called "flour foods" so much used in Austria-Hungary, and often especially well prepared in private houses and the best hotels, are made from this dough. They are of great nutritive value because of their high carbohydrate content, which is still further increased by the addition of butter and other fats. To be sure, these "flour foods" are sometimes rendered quite indigestible by the additions referred to, particularly if the potatoes have not been properly prepared beforehand. The further addition of poppy seeds, nuts, preserves, etc., may make them still more indigestible. The most easily digested of them are noodles, which are made from such dough rolled into thin sheets and dried. They are also well absorbed in the intestine, and their assimilation is improved when the yolks of a few eggs are added to the dough. Macaroni, which is rich in gluten, is also well assimilated. Rubner found that when macaroni or noodles contained only a limited quantity of albumin 17 per cent. thereof remained unused, but that in those rich in gluten only 11 per cent. was lost. Macaroni is a very valuable article of diet, chiefly because it is very nutritious; it is especially so when eggs have been added, which is very rarely the case in the varieties offered for sale. The commercial noodles, poor in eggs, the so-called "water noodles," contain, according to König,[1] 10.88 per cent. nitrogen, 0.62 per cent. fat, 1.36 per cent. sugar, 2.10 per cent. dextrin, 72 per cent. starch, 0.42 per cent. cellulose, and 0.64

[1] König, ii, p. 343.

per cent. ash, together with 0.261 per cent. total phosphoric acid and 0.0228 per cent. lecithin-phosphoric acid. The nutritive quality of egg-noodles prepared at home is much greater. In these, when at least 4 eggs have been used to the kilo of flour, König states that there is contained nearly 4 per cent. more of albumin, which thus amounts altogether to 15.16 per cent.; more total phosphoric acid, 0.392 per cent., and above all more lecithin, 0.1212 per cent.

We have every reason, therefore, to accord a first place to macaroni as a nourishing food, for even the ordinary commercial varieties represent per kilo the very respectable total of 3360 to 3600 calories, so that if an adult should eat ¾ kilo of macaroni per day he would fare very well. Nor would his nourishment be very one-sided, for it would contain albumin and carbohydrates; it would only be somewhat lacking in fat. Combination with it of some grated cheese, such as Parmesan, would furnish some albumin and fat, and would also aid in its assimilation. We can thus understand how it is possible for the poorer classes among the Neapolitans to live chiefly upon such a diet, just as the Eastern Asiatics live upon rice. Even though they may, as I have myself seen, share their living room with a chicken, turkey, or even a pig, the meat of this much-beloved family companion is only eaten at Christmas, and during the rest of the time they are enforced macaroni-eaters and vegetarians. We can learn much, however, from their frugal way of living, and would do well to imitate them in eating macaroni. The Italian macaroni is, to be sure, of the very finest when made in the best factories, but a very good quality is also made in this country. I frequently recommend macaroni as a healthful addition to the midday and evening meals of my patients in Carlsbad, as it is nutritious and easily digested, and does not impose any hard work upon the stomach and intestines. It is well tolerated and assimilated. Nor does macaroni contain any injurious substances, either for the liver

or the blood-vessels, and it thus forms an ideal food for liver and kidney patients, as well as for arteriosclerotics and gouty persons, since it does not lead to the formation of any uric acid, being free of purin bases. It should also be added that macaroni when taken in considerable quantities antagonizes intestinal putrefaction, like foods rich in carbohydrates in general, as has been shown by Combe. As a component part of a vegetable diet macaroni is thus a most valuable addition; it is really to be wondered at that such valuable vegetable foodstuffs as these—macaroni, tapioca, sago, etc.—are scarcely ever to be found on the bill of fare of most vegetarian restaurants, in which the cheapness of the foods is a chief consideration.

As a breakfast food, another variety of the healthful "flour foods," which are much used in America, would be advantageous. "Grape-nuts," for instance, in which the floury substance has been dextrinized by roasting and thus rendered digestible and easy of assimilation, is eaten with cream and would be a useful addition to our usual very sparing breakfast. In the United States, this or some other product of wheat or corn meal, such as cream of wheat or hominy, is regularly taken at breakfast. Much more palatable, however, are the almost universally used flat pancakes, or "hot cakes." They are made of corn meal or buckwheat flour, and are piled up one over the other, spread with butter and maple syrup. The corn cakes are preferable, since they are much more nutritious, and also more digestible, than the buckwheat cakes. With us these cakes would be even more digestive, since our butter is fresher and of a finer quality, while in America the butter is salted and does not come to the table fresh each day. With the addition of butter and syrup, which would be replaced by us with pure honey, or honey mixed with fruit syrups, these corn cakes would furnish a very complete article of diet, since they would contain albumin, fat, and sugar. Such a breakfast would be especially advisable when a strictly vegetarian diet is being fol-

lowed, since, with that kind of diet, albumin-containing foods and those yielding many calories are a necessity. A very light breakfast of coffee and rolls constitutes a serious mistake for those following a strictly vegetarian diet.

It is obvious that these additions to the breakfast, which are quite suitable in the diseases mentioned when speaking of macaroni, would not be indicated in obesity or diabetes, and should in the latter affection be strictly forbidden. In very light cases of diabetes, buckwheat cakes—with the addition of plenty of butter and a little fruit syrup—might be indulged in, since the assimilation and absorption of the carbohydrates by the intestines is interfered with owing to the high content of cellulose.

3. *Concerning Bread, and the Advantage of Brown Bread over White Bread.*

How greatly man depends upon his daily bread can only be appreciated by a Carlsbad physician who, like the author, is often obliged to restrict his patients in the use of bread. There is hardly any other article of food which man finds so hard to give up, and many persons would much rather give up meat than bread. Since the most remote times man has been accustomed to this food, which he eats daily from early childhood. Recently I saw at the British Museum remnants of bread in the coffins of the old Egyptian mummies, which proved that already thousands of years ago this food was greatly prized by man.

No other foodstuff used by man is more satisfying than bread when taken in combination with other articles of diet, and many of the latter gain thereby in nutritive value and power of assimilation, as, for instance, milk. The feeling of satiety is more particularly felt when dark bread is eaten; the latter also seems to have more taste. Most people find a fine

white bread less to their taste. When we ask for bread, we do not care for a "flour food," but want a true bread, that is to say, a dark bread. In the shape of rolls, white bread may be satisfactory, since these at least have a good hard crust already dextrinized, and consequently more digestible, and real bread lovers greatly prefer the crust to the soft, white crumb. It is better for the teeth, too, to eat the hard crust and crumb of a not quite fresh black bread, and it is very probable that, for the development of the teeth of a growing child, daily gymnastic exercises, so to speak, with his teeth in nibbling at such hard bread are preferable to swallowing some soft bread almost without masticating it. Even the dog looks instinctively for a hard bite when his master inadvertently provides him with nothing but soft food, and such dogs sometimes try to bite wood, or even hard stones, as I have myself seen. Dark bread has another advantage, namely, that it contains the outer portions of the grain, the glutinous substance, which is more rich in albumin. When the flour of white bread is too finely ground it doubtless contains more starch, but this is not such an important consideration, for we have plenty of starch-containing foods in the vegetables at our disposal. We need rather plenty of albumin in our bread, for the albumin-containing foods are more rare among the vegetables. Potatoes can be accepted as a substitute for the starch content of bread, but cereals do not in this sense form a bread substitute. When bread containing less starch is taken, we can, as is usually done by diabetics, make up the deficiency by eating potatoes, but this cannot be so well done with cereals. White bread made from the finest flour product of the rolling mills has another great defect, that of furnishing too little phosphorus, lime, and iron. Balland[1] states that fine white Parisian bread contains a minimum of 0.06 per cent. phosphorus and 0.15 per cent. of phosphoric acid, and a maximum of 0.18 per cent., while the

[1] Balland: *Loc. cit.*, p. 285.

coarser bread furnished to the soldiers contains almost twice this amount of phosphorus. We may learn the quantity of nutritive substances contained in various kinds of bread by consulting the following table by König:—

Breads.	Proteids. Per cent.	Sugar. Per cent.	Starch. Per cent.	Cellulose. Per cent.
Of fine wheat flour ...	6.81	2.01	55.69	0.31
Of coarse wheat flour .	8.44	3.34	47.10	1.12
Graham bread........	8.10	....	47.56	1.02
Rye bread............	6.43	2.51	47.93	0.80
Pumpernickel	7.16	3.28	43.16	1.48
Biscuit (zwieback)	8.80	17.80	55.64	0.39

We see by the above how much more albumin is contained in the coarser wheat flour, but it nevertheless has the drawback that such a gluten-containing bread is more poorly assimilated. Rubner[1] states that of the finest wheat flour 21.8 per cent. is lost, and of the coarsely ground shelled grain about 7 per cent. more. In flour of a medium quality only about 3 per cent. more are lost. It is consequently advisable for us to use bread of a medium quality, as otherwise we must allow for 7 per cent. more; but even though the nutrient salts are more poorly assimilated, we can make up for this. It would be advantageous to mix fine rye flour and wheat flour for making bread. Such bread would be preferable to white bread, because it would stimulate the bowels to a much greater extent than bread entirely free from bran. Bread made entirely from coarse rye flour would, nevertheless, not prove healthful, as according to Rubner much of the albumin is lost, reaching when baked with yeast the enormous amount of 46.6 per cent., and 14 per cent. of carbohydrate; with a "sour dough," or leaven, 32 per cent. of albumin and 10 per cent. of carbohydrates. For a healthy person, however, such food would not be so bad, and in case the digestion were to suffer, bread made from shelled,

[1] Rubner: Lehrbuch der Hygiene, 8, Aufl., S. 476.

coarsely ground wheat could be substituted. In countries where the people eat large quantities of rye bread we find them to be in such a perfect condition of health that we must conclude that this coarse bread diet is not a disadvantage, but rather the contrary. The chief objection to these coarse breads is that the quantity of feces is greatly increased, which tends also to interfere with the assimilation of the other foods. That most to be recommended from the standpoint of health would be the Graham bread made from shelled whole, milled grain. The leavened pumpernickel is less desirable, as 43 per cent. is lost in the intestine. According to Rubner, 26 per cent. of nitrogen and 7.5 per cent. of carbohydrates are not assimilated in the Graham bread.

A healthy person can, however, eat pumpernickel, and it is really an excellent breakfast food, which should be more widely used. The above-named breads may also do good service for diabetics, since owing to the considerable cellulose content the sugar is slowly and with difficulty carried into the blood, so that the elimination of sugar is very little influenced. I consequently prefer to order small amounts of such bread for my diabetic patients, in preference to the less tasty diabetic breads. For people with delicate stomachs and intestines the easily digested white bread is to be recommended, and particularly zwieback, in which the starch has been converted into a more soluble and digestible form. By simply drying or broiling the slices of bread, thus making the never-failing "toast" of the English and American breakfast tables, bread can be more readily digested. It is also more easily masticated, and for this reason a somewhat stale bread is to be preferred to that freshly baked.

The most healthful bread of all would be that made in the old-fashioned way by grinding wheat between two stones, in which manner all of the nutrient substances and salts are

preserved. When we consider that the poor get almost all of their daily amounts of nutrient salts from bread, we must consider it as a crime against the public welfare when, through greed for gain, or for technical reasons, as is the case in the rolling mills, the flour is largely robbed of its nutritive salts and other substances. The building up of the bony structure, the chest expansion, the development of the lungs, and, consequently, the general health of the population at large stand in intimate relation to the above. Fine white breads are, at all events, to be condemned.

4. *The Advantages of Rice as Food.*

Millions of people in eastern Asia, India, and the Indian Archipelago live almost exclusively upon rice, and with this diet they possess such indefatigable energy and industry as is scarcely to be found among those who subsist on other food. The reason for this great capacity for work lies in the nature of their staple food. Rice contains such a large amount of carbohydrates (about 80 per cent.) that it heads the list of vegetable foods in this respect, and we know that muscular work is principally accomplished through the agency of the carbohydrates. While, however, the rice-eaters—the majority of the Chinese, according to Kintaro Oshima[1] about 75 per cent. of Japanese, and most of the Hindoos live almost exclusively upon rice—are untiring in their work, they are not characterized by very robust health. We observe that the Hindoos, for instance, are thin and withered looking, and they have no powers of resistance. Just as is the case with insufficiently or not at all manured plants and badly nourished animals, the Hindoos fall a ready prey to all kinds of infectious diseases. Epidemics are prevalent among them, and they offer no resistance to their inroads. This is due to the fact

[1] After Chittenden, *loc. cit.*

that their food, the rice, is very poor in the most important component part of our food, the albumin, of which it contains 5.56 per cent., together with only 0.3 per cent. of fat; it also contains but little of the nutritive salts. This is a result of the unhappy condition which likewise prevails in the preparation of our other cereals, namely, the robbing of grain of its shell, which contains appreciable quantities of phosphorus and other inorganic nutrients. I may mention, in illustration, that the rice sent to Paris from the French colonies contains when unshelled a maximum of 0.35 per cent. of phosphorus. Shelled and polished rice, as it is usually eaten, contains a maximum of 0.07 per cent. The same was stated by Jebbink, who found in unpolished, uncooked rice 0.26 per cent. phosphoric acid, while in the polished and cooked rice there was less than the half—0.12 per cent. In order to make rice more digestible it is not only deprived of its shell, but another fine membrane, the "silver skin," is also lost, which is rich in nutrient salts, particularly in organic phosphorus. Eikmann states that it contains as much nutrient salts as the rice-kernel itself, so that with this membrane the content is about doubled. This fine skin also contains much nitrogen, so through the polishing process the rice loses greatly in nutritive value. We, unfortunately, eat only such rice. It is sent to us with the shell on—otherwise it would lose all taste during the transport—and in the rice-mill it is then robbed of its shell and, unfortunately, also of its "silver skin" by the polishing process. We shall now show the nutrient salt content of the shelled and polished rice according to E. Wolff[1] :—

Nutrient Salts in the Rice Kernel (Shelled)

Potash. Per ct.	Soda. Per ct.	Lime. Per ct.	Magnesia. Per ct.	Iron oxide. Per ct.	Phosphoric acid. Per ct.	Sulphuric acid. Per ct.	Silicic acid. Per ct.	Chlorine. Per ct.
21.73	5.50	3.24	11.20	1.23	56.68	0.62	2.74	1.10

[1] E. Wolff: "Aschenanalysen," Berlin, 1871, p. 154.

Nutritive Salts in 100 Grams of Rice Flour.[1]

Potash. Per cent.	Soda. Per cent.	Lime. Per cent.	Iron oxide. Per cent.	Phosphoric acid. Per cent.	Sulphuric acid. Per cent.
0.253	0.043	0.038	0.014	0.543	0.008

We see from the above analysis that rice, even though it is but poorly mineralized as we eat it, has the advantage of belonging to the class of foods containing but little common salt, and that owing to its content of potash and soda less salt is required to be added in flavoring it. This makes it a very desirable food for diabetics, since its decomposition products have no injurious action upon the kidneys. Among all foods rice and milk are the least injurious for the kidneys. Rice, owing to its easy digestion and assimilation, is, when well prepared, a very good food in stomach and intestinal diseases. When insufficiently cooked it is rather hard and is not so well digested; when too much cooked it takes up too much water and loses all taste. The best way is to steam it for a long time. In Italy, prepared as risotto, it is not very digestible; in Spain I have eaten it colored with saffron and containing sea-mussels; it is called arroz à la Valenciana, and I found it very palatable. In England rice is often used as a cold pudding, in which form it is very good. In my country it is frequently mixed with raisins and cinnamon, which increases its palatable and nutritious properties. Since rice contains but little fat, butter should be added to it. Sugar also improves its taste; and when sugar-peas are added, in which form—"risi-bisi"—it is a food much used in Austria, the otherwise rather limited albumin content is considerably increased.

Rice, as a food, is very useful in diseases of the liver, and in affections of the blood-vessels and heart. It is also to be recommended in gout, as it does not form uric acid. For persons who prefer a vegetable diet, rice should never be absent from the bill of fare. Obese subjects and diabetics

[1] After Schall and Heisler, p. 32, C. c.

should strictly avoid its use. It is a peculiar fact that this food, which is very useful for us, often proves injurious for the inhabitants of oriental and tropical countries. It is not the rice itself, that valuable gift of Providence, which is hurtful, but the manner in which it is prepared and eaten. The Orientals, like the Japanese, are in the habit of adding the strongest kinds of spices to the rice, which is somewhat tasteless of itself. While visiting patients in Holland who owned sugar plantations in India, I have eaten rice prepared in this way. Many dainty dishes are served at their table, but the rice was cooked with so many strong spices, including black and red pepper, that my mouth fairly burned after eating it. In tropical climates such highly flavored foods are doubtless less injurious, since, owing to the very great activity of the skin, they are probably eliminated through it rather than by the kidneys. The beneficent design pervading all the creations of Nature is shown by the fact that it is in just these hot climates, or with us in summer, that such spices grow; their use in a damp, cold climate such as that of Holland would be very injurious. While the rice itself is advantageous for our kidneys, spices added to it are very detrimental.

Because the natives of the countries in which rice is cultivated constantly eat it in the shelled and polished form, they are subject to a terrible disease with marked nervous symptoms,—beriberi. As has been proven in the Japanese navy, the sailors are immune to this disease when they can get plenty of meat. Eikmann's experiments upon chickens show that when they were fed upon polished rice they were usually affected by polyneuritis, the cocks more so than the hens. When the rice still had the "silver skin" the chickens never became diseased, and when raw meat was added they were in fine condition. He ascribes the disease to the absence of the "silver skin," causing a lack of valuable nutrient salts. An interesting fact reported by Vordermann is that in Java, among the occu-

pants of 52 prisons, beriberi occurred in 72 per cent. of those fed upon polished rice, while in 37 prisons in which the unpolished rice was furnished as food only 2.7 per cent. were affected. Without devoting any further space to the discussion of this important subject we may still briefly mention that experiments made by Hulshof Pol, Nocht, and Schaumann confirm the opinion, which has recently been further strengthened in a recently published dissertation by Jebbink, that beriberi is caused by a lack of phosphorus. We might also add that a one-sided diet, as was stated in referring to pellagra in a previous chapter, diminishes the protective resistance against infectious diseases, and also causes a lack of phosphorus.

We should consider the lack of phosphorus as a predisposing factor, since Aron and Hodgson[1] have shown, in their experiments upon monkeys, that it diminishes the resisting power against infection. This deficiency might also be accepted as a direct etiological factor, as it produces nervous symptoms which are improved by the absorption of organic phosphorus in the food. Thus, Hulshof Pol obtained very favorable results in the prophylaxis and treatment of beriberi by the administration of kaljang-idjoe, an Indian variety of bean, containing considerable phosphorus.

5. *Corn: Its Advantages as a Food.*

It has been observed that, in countries where much corn is eaten, tuberculosis and epilepsy, as well as kidney disorders, are extremely rare. We shall not here question the correctness of this statement, but it is an undisputed fact that corn is a very valuable article of food. It is another of the many anomalies to be met with in our method of nourishment that a foodstuff containing 10 per cent. of albumin, over 5 per cent. of fat, and about 70 per cent. of carbohydrates, as well as many nutrient

[1] Aron and Hodgson: *Loc. cit.*

salts, should in our country be chiefly used to feed pigs and to fatten geese and ducks, while thousands of persons are suffering from hunger, and would gladly eat the food thus given to animals. One might be led to suppose that this perversity is due to the fact that corn is disagreeable in taste. This is certainly not the case, for during two voyages of seven months each in the United States, Canada, and Mexico, all of them countries in which much corn is eaten, I was able to convince myself that corn meal prepared in various ways tastes very good, and I enjoyed eating corn bread, corn cakes, etc., almost every day. I found these corn foods more palatable in the northern part of the United States, where the sweeter, yellow corn is used, than in Georgia, Louisiana, South Carolina, etc., where white corn meal was used in the foods set before me in hotels.

While thus the taste would not be a deterrent factor in the use of corn, the objection might be made that it is hard to digest and also poorly assimilated. This is also certainly not justified, for while partaking of it daily during a long time I never noted any difficulty in the digestion except after having taken too much corn bread. Malfatti also states that corn and rice, as well as fine and medium-fine wheat flour, are well assimilated.

Corn being easily assimilated as well as palatable, most timid people might be afraid of pellagra. Any such fear can at once be allayed, for I never personally heard of a single case of pellagra while in the Northern section of the United States or in Canada, and, since this disease principally occurs among the lower classes in Italy and the Adriatic maritime countries, it may be ascribed to a one-sided diet, just as in beriberi, which affects only the natives of eastern Asia living almost exclusively upon rice. Pellagra is probably caused by bacterial toxins, which are not formed in fresh corn, but in old corn through the decomposition of the gluten in its outer shell. It is most likely,

however, that it is the one-sided and scanty food and malnutrition which give rise to pellagra, just as with the rice-eaters beriberi is developed owing to a decreased power of resistance against infection.

We see therefore that there is no valid reason for thus neglecting such a valuable article of diet as corn. The greatest mistake consists in the fact that vegetarian restaurants do not include this article of diet in their rather limited bill of fare, which does not offer many albumin-containing foods, with the exception of certain vegetable fats, and this especially since corn is cheaper than many other cereals, such as wheat, etc.

A multiplicity of palatable foods can be made with corn, such as cakes, corn bread,—the latter of which is best when mixed with rye flour, as it is made in many sections of Hungary, Croatia, and Servia,—gruel, or pap, like the polenta so much used in Italy. Mixed with eggs and milk or water and butter, and baked in a pan, it makes a very agreeable food, "malé," which is much liked in Hungary and Croatia; these cakes are often spread with honey, which makes them even nicer. In Mexico and California I saw corn prepared as "tamales," a dish which is flavored with Spanish peppers, "chile." The flat corn cakes which are used as a breakfast food in the United States have already been referred to. The maizena, "mondamin," made from cornstarch, when mixed with milk and eggs in the form of "blanc-mange," is one of the most easily digested foods, probably not surpassed by any in regard to its assimilation by the intestine.

Corn itself, when on the cob, is a much-liked food, when roasted or boiled. In America, corn is thus used as a vegetable, but for weak stomachs or where there is a tendency to intestinal disturbance it should never be indulged in, as it is very indigestible. In addition to its great nutritive value, corn contains certain valuable salts, such as phosphorus. In 100 grams, according to Schall and Heisler, there is contained 0.689 gram

phosphoric acid, and, according to Balland, between 0.2 and 0.35 of phosphorus and 0.47 and 0.80 phosphoric acid; Jebbink states that raw there is 0.83 per cent. and cooked 0.31 per cent. The nutrient salt content of the ash, both of corn and of corn flour, is as follows:—

NUTRIENT SALT CONTENT OF CORN GRAINS.[1]

Potash.	Soda.	Lime.	Magnesia.	Iron oxide.	Phosphoric acid.	Sulphuric acid.	Silicic acid.	Chlorine.
Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
29.78	1.10	2.17	15.52	0.76	45.61	0.78	2.09	0.91

NUTRIENT SALT CONTENT OF CORN FLOUR.[2]

Potash.	Soda.	Lime.	Magnesia.	Iron oxide.	Phosphoric acid.	Sulphuric acid.	Silicic acid.	Chlorine.
Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
28.50	3.50	6.37	14.80	1.51	44.97	—	—	—

According to the composition of Schall and Heisler,[3] 100 grams of fresh corn flour contain:—

Potash.	Soda.	Lime.	Magnesia.	Iron oxide.	Phosphoric acid.	Sulphuric acid.	Silicic acid.	Chlorine.
Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
0.449	0.017	0.033	—	0.011	0.089	—	—	0.014

Corn thus contains considerable amounts of these salts, and particularly of phosphorus, and also appreciable quantities of iron, although of the latter substance more is contained in wheat and oats.

That wheat is a healthful food is shown by the fresh appearance of the people for whom it forms a staple article of diet. The inhabitants of the Franche-Comté in France are characterized by their appearance of robust health. There are probably no more hard-working people than the Italian laborers employed on the railroads, who eat polenta as a daily food; they can endure great fatigue, like carbohydrate-eaters in general, and with it all look to be more healthy than the

[1] E. Wolff: "Aschenanalysen," Berlin, 1871, p. 36.

[2] After Stepf and König.

[3] *Loc. cit.*, p. 32.

rice-eaters, since corn also contains albumin and fat, both of which are poorly represented in rice, as we have seen in the preceding chapter.

(*i*) Starch-containing Tubers.

White and Sweet Potatoes, Manioc, Sago, Tapioca, and their Advantages.

Just as is the case with bread, many people feel that they cannot do without potatoes. Especially in the northern regions, as in Scandinavia, and even more so in Ireland, does the potato form a chief part of the daily food. In many sections of northern Hungary the Slovaks live almost exclusively upon potatoes. In my country, too, there are large numbers of people from whose tables they are never absent; this great liking for them, which seems to be almost instinctive, is readily understood, for in this region potatoes, together with bread, supply our daily needs of carbohydrate materials, of which potatoes contain 16 to 22 per cent. They also constitute—particularly new potatoes—a very agreeable food, especially when well prepared. The taste-bearing constituents in them disappear very rapidly, so that when they are pared and placed in water they soon lose their taste, especially when the water is heated. For this reason potatoes should always be boiled in the skins; the best way is to put them into boiling water and let them cook for about half an hour, until they are quite soft. When the potatoes are sufficiently cooked, they should be peeled and served at once, for their taste is rapidly lost. Whoever is fond of potatoes should not come late to meals in a hotel, but should endeavor to be among the first, for when peeled and prepared some time before, they no longer taste very good; even the delicious new potatoes get hard. The digestibility of the potato also depends upon the manner of its preparation, for we must remember that the digestible

nourishing portions, the starch granules, are imbedded in a covering of cellulose. These shells may be expected to burst open in the cooking, so that the digestive juices can act upon the nutritious substances within. When potatoes have been thoroughly cooked and are served mashed in the form of a purée, they give the stomach but little work, and can be well assimilated in the intestine, for the cellulose can then do no harm. The case is very different, however, when potatoes are sliced and fried, and perhaps only partially cooked through. They then seem tender on the outside, but the cellulose in the interior portions has not been rent asunder; the starchy portions remain in a raw condition, and, as Strassburger has shown, appear undigested in the feces. When potatoes are taken in the form of a salad, about 7 per cent. of the carbohydrate constituents is lost, according to Rubner. The most healthful way, therefore, is to eat potatoes in the form of a purée. Good, dry, mealy potatoes, when steamed, sliced and browned, are well tolerated and assimilated. Whole roasted potatoes are indigestible, badly assimilated, and often give rise to acid eructations; they are consequently not adapted for stomach and intestinal troubles.

The taste of potatoes and the amount of starch contained in them depend upon the climate and soil. In some countries, in England and Holland particularly, they grow very well and have a very excellent taste. The starch content is dependent upon the sun they receive, as is the case with tubers in general, for through the influence of the sun's rays the starch, which is formed in the leaves, is stored up. The tubers in these plants may be said to occupy about the same position in their makeup as does the liver with us, since the starch is also deposited in this organ, to be converted into sugar as required and then consumed. After a summer in which there has been plenty of sunny weather, the potatoes show an unusually high starch content. Generally the amount ranges from 16 per cent. in

the young potatoes to 22 per cent. in the old ones; the older the tuber, the more starch has been deposited in it. Of the other nutritive substances, *e.g.*, albumin, the potato contains but little, the minimal amount being 0.69 per cent. and the maximum 3.67 per cent.; of fat there is even less,—0.04 to 0.96 per cent. Following is the average composition of the potato, according to König[1] :—

Water.	Protein.	Fat.	Carbohydrate.
74.93 per cent.	1.39 per cent.	0.15 per cent.	20.86 per cent.

The potato not only contains very little albumin, but only about one-half of this is digestible; the rest occurs in the form of amino-compounds,—for the most part asparagin,—which may probably also play some useful rôle.

Since potatoes contain so little fat, it is advisable not to eat them alone, but to add butter. Dry potatoes certainly do not taste good, but fresh potatoes with good butter, or potatoes browned in butter, with a crisp, appetizing crust, as they are so deliciously prepared in Paris, and occasionally in England, are most palatable. As potatoes are poor in albumin, and meat, on the other hand, is poor in carbohydrates, these two articles of food should go hand in hand, as it were; a roast of meat does not seem complete without potatoes, nor do the potatoes without meat. To be sure, good potatoes carefully fried are by no means to be despised as a food when eaten alone, but in a vegetable diet they do not play the same rôle as for the meat-eater, since the vegetarians can better obtain their required amounts of carbohydrate from rice, sago, tapioca, etc. These contain a much greater total of carbohydrate material and are consequently more nutritious for the vegetarian, while potatoes are more voluminous and less nutritious. According to Bunge, potatoes also give rise to a craving for salt, owing to the large amount of potash and the slight quantity of soda

[1] König, ii, p. 892.

contained in them, as a consequence of which more common salt is excreted and must be again replaced.

The diet of the vegetarian is, in general, already poor in salt, so that he should not add to it large amounts of any article of food which will increase the desire for salt further. Rice is, therefore, far preferable for him. The potash content is greater than that of, perhaps, any other food, amounting to 60 per cent. We shall now describe the mineral contents of the potato, as given by König.

The ash of potatoes contains the following percentages of the various nutritive salts[1] :—

Potash.	Soda.	Lime.	Magnesia.	Iron oxide.	Phosphoric acid.	Sulphuric acid.	Silicic acid.	Chlorine.
60.06	2.96	2.64	4.93	1.10	16.80	6.52	2.4	2.46

As to the content of phosphorus, one of the most important of the mineral substances in our food, potatoes when cooked contain, according to Jebbink, 0.10 per cent. of phosphoric acid; according to Balland, 0.01 per cent. of phosphorus and 0.22 per cent. of phosphoric acid. In the table of Schall and Heisler[2] 160 milligrams of phosphoric acid are given as being contained in 100 grams of the fresh substance.

The following amounts of the nutritive salts are present in 100 grams of the fresh substance:—

Potash. Per cent.	Soda. Per cent.	Lime. Per cent.	Iron oxide. Per cent.	Chlorine. Per cent.	Phosphoric acid. Per cent.
0.571	0.028	0.028	0.010	0.023	0.160

When we wish to introduce many alkaline substances into the body, potatoes render good service; large quantities will render the urine alkaline. Mossé states that in 1 kilo of potatoes there is contained almost as much of alkaline substance as is present in 1 liter of Vichy water, and he has also observed—as is often the case after the use of alkaline waters—that the sugar in the urine of his diabetic patients was con-

[1] König, ii, p. 898.

[2] Schall and Heisler: *Loc. cit.*, p. 32.

siderably decreased after potatoes had been eaten, for which reason he recommends a diet exclusively of potatoes in the treatment of diabetes. The sugar really does often disappear after such treatment, but, as I have stated in my work on new methods and measures of treatment in diabetes, we possess more rational modes of treating this disease than such an impracticable and purposeless diet, in which the lack of albumin in the food would surely also exert a therapeutic influence upon the diabetes. In addition to the potash content the asparagin no doubt also plays a rôle. Stocklasa and Biernacki have shown that a large content of potash in the food greatly favors the breaking down of carbohydrates.

It would be a great mistake to allow all diabetics to take potatoes; I have myself seen injurious effects follow reckless use of this food in diabetes. As soon as meat is given together with the potatoes, the elimination of sugar is readily increased. It would be best to use the potatoes in small quantities, fried or, better still, in the form of salad, since they are then not so well assimilated. In obesity potatoes should not be allowed, since the fat may be increased owing to their carbohydrate content. In kidney diseases the increased amount of salt taken with the potatoes might come into play. They also contain purin bases—uric acid producers—according to Bessau and Schmidt, to the extent of 0.002; this is really but a small amount, so that potatoes need not be strictly forbidden in gout. Their tendency to produce flatulence should be given due weight in gout as well as in arteriosclerosis. If, however, the potatoes are taken in the form of a purée, instead of fried or roasted, flatulence may be avoided. The question must be well considered before such a much-used and well-liked food as the potato is absolutely forbidden.

In the tropics and in the United States, a kind of sweet potato is frequently eaten. I found the taste of sweet potatoes very agreeable, something like a chestnut purée, and often ate

them fried, and liked them very much. I found them somewhat indigestible, however, somewhat less so when boiled, but am inclined to think that they are more apt to cause acidity of the stomach than our native potatoes. It would be well to cultivate this useful variety of potato in our country.

In countries where the sun is almost always shining, thus causing great heat, a great quantity of starch is formed in the tuberous roots of certain trees, as in the "manihot" tree, called the cassava tree in South America and Java, which belongs to the Euphorbiaceæ. When the knots on the roots of these trees, which are often very large, are cut open, a white, starch-like mass will be seen to fill the cavity. After having been very carefully cleaned, for the removal of a poisonous substance, this starchy mass is then spread out on a hot metallic plate. From the manioc, and also from the starch obtained from the roots of a tree belonging to the Marantacea, the *Maranta arundinacea* (arrowroot), as well as from the Colocaria Taro in Africa and Tahiti, the Curcurmartes, various starch-containing substances like tapioca are made. The trunks of palm trees contain a great deal of starchy flour, and from it sago is made, which consists of little granules. Tapioca and sago are also made in Europe from the starch obtained from potatoes. These foods present many advantages. In the first place they are nutritious, since they contain 78 to 88 per cent. of carbohydrates, in such a form that it is scarcely equaled by any other food in regard to the assimilation of the starches; they are almost entirely free from cellulose, and therefore the intestinal juices can act fully upon them. They are consequently very easily digested both by the stomach and intestines, and do not impose much work upon the stomach, although they remain in it for some time, as the gastric juices do not digest the carbohydrates, which are digested by the saliva and intestinal juice. In cases of intestinal disturbances the best among the carbohydrate foods would no doubt be sago or tapioca; they would be

less desirable in overacidity of the stomach. Since they are rather tasteless, and are not rich in albumin (0.30 to 1.13 per cent.), it would be desirable to mix them with milk or make puddings of them with eggs and milk or cream. Such a pudding is most easily digested. It might be stated, in reference to their action upon the intestines, that these starchy foods, owing to their content of sugar, have the property of causing a lactic acid fermentation in the intestine, which, so to speak, disinfects it, and has a beneficial effect upon the entire organism. In kidney affections they are a most excellent food, since they contain absolutely nothing which might prove injurious to the kidneys; the same may be said of the blood-vessels; so they are a good dietetic food in arteriosclerosis, as well as in gout, since they do not form any uric acid, being entirely free from substances which produce it. For delicate persons, these foods are ideal, but they are not well adapted for strong, healthy men, for whom a carbohydrate food which requires some chewing, like hard black bread, or one containing cellulose in a sufficient quantity to act upon the intestine, would be preferable. Foods like sago, etc.,—rich in carbohydrates and very easily assimilated,—should play an important part in a vegetarian diet, in which the cellulose is well represented, but the easily digested forms of carbohydrates less so. In this connection, tapioca and sago, corn and other fine, starchy flour, would be ideal. That these foods would be poison, so to speak, for diabetics is clear. The sugar contained in them is absorbed in large quantities at a time, and the organism is flooded with it; it is therefore preferable for such patients, when they require the carbohydrates, to take them in foods containing much cellulose, so that the sugar be only gradually absorbed, and the sugar-destroying agents in the body have time to convert it into an eliminable product. When we forbid the use of these foods in obesity and advise those rich in cellulose, we are actuated by similar motives.

(*j*) Mushrooms.

Certain fungi, *i.e.,* edible mushrooms, which are quite unique in their nature, form a wonderful food. For it really is wonderful that in just a few hours, after a rain, these structures appear in the woods, having been fully developed in this short time, and containing, as they do, quite large amounts of nutritive substance. The expression "they spring up like mushrooms" indicates how rapidly they really do grow; this wonderful process will be better understood when we remember that the fungi belong to the same large class of plants as the bacteria; the latter, we well know, develop in enormous numbers in a very brief period.

Their wonderfully rapid growth does not prevent the formation of large quantities of valuable nutritive substances, and many of the fungi are very rich in proteids and in carbohydrates. The yellow mushroom, *Elaphomyces granulatus,* contains the large amount of 19.19 per cent. of proteids and 47 per cent. of carbohydrates in the fresh substance, but of the 19.19 per cent. of proteids only 13.40 per cent. is assimilated and of the 47 per cent. of carbohydrates about 10 per cent. is lost. The *Fistulina hepatica* contains 10.40 per cent. of carbohydrates, of which more than 2 per cent. is lost. Nevertheless, these fungi are very nutritious, and one may readily understand why mushrooms are considered by some as vegetable meats, and why a French author—Bertillon, I believe—called them "Gibier sans pattes" (game without feet). Just like game, many of them live in the woods in damp, dark places, but among these many are poisonous. Their toxic properties may perhaps frequently be due to decayed animal substances or other dead organisms in the ground, which have been absorbed by the fungi. Even the edible varieties of the latter may, at times, have a poisonous action, as they become very rapidly decomposed when kept for any length of time. Just

as soon as they are formed they also begin to deteriorate, a property which they have in common with many other organisms. Mushrooms and other fungi should therefore be used when quite fresh, and to have them warmed up a second time is always very poor economy. Mushrooms, owing to their pronounced taste, are often used to flavor other foods, and are also helpful for the digestion. As a general thing when eaten alone they are very indigestible. This is due to the fact that most of them contain a large amount of cellulose. When one touches them, their tough consistency can at once be felt, and, even when cooked, one feels in one's mouth that they contain a hard fiber, and cannot be readily masticated. Mushrooms belong to the more easily digested varieties; they contain only 0.83 per cent. of cellulose; the *Cantharellus cibarius* have 0.96 per cent. of raw cellulose, the *Fistulina hepatica* 0.83 per cent., while the *Morchella elata* have 0.8 per cent. The most difficult to digest is the truffle, which contains 7.20 per cent. of cellulose, and when dried even as much as 27 per cent. It is really one of the most indigestible food substances. The other varieties above mentioned may be recommended as being digestible, but certainly not the truffle. They are particularly not to be recommended, too, when we consider the shameless and unappetizing way in which they are imitated. The best and least indigestible variety comes from Périgord, in France. The indigestibility of the truffle does not prevent its being in great demand by "gourmands," and France furnishes them to the amount of several millions of marks per year.

Although some varieties of fungi are very rich in nitrogenous substances, only a portion of these can be taken into account, since only 62.88 per cent. of the nitrogenous compounds include true protein which can be assimilated by the tissues. Of the true protein, according to the experiments on man by Saltet and Uffelman with mushrooms as they are usually prepared, only 61 to 66 per cent. can be assimilated;

with air-dried and pulverized mushrooms as much as 72 per cent. can be digested. The experiments of Mörner show that of the nitrogenous substance contained in the fungi and edible mushrooms only about 60 per cent. can be digested.

We shall now give, according to J. König, ii, p. 1488, a list of fungi and mushrooms, in which will be found the quantity of nutrient substances contained in them, together with the amounts assimilated:—

Fungi and mushrooms.	In the fresh substance.			Quantity assimilated.	
	Proteids. Per cent.	Carbohydrates. Per cent.	Wood fiber. Per cent.	Proteids. Per cent.	Carbohydrates. Per cent.
Field mushroom	4.88	3.54	0.83	3.42	2.86
Cantharellus cibarius	2.64	3.81	0.96	1.95	3.05
Lactaria deliciosa	3.08	3.04	3.63	2.16	2.47
Boletus bulbosus	5.39	5.12	1.01	3.77	4.60
Boletus luteus	1.48	3.95	1.22	1.04	3.16
Fistulina hepatica	1.59	10.40	0.83	1.11	8.32
Elaphomyces granulatus	19.14	47.00	5.45	13.43	37.60
Morcella elata	3.28	4.50	0.92	2.30	3.60
Helvella lacunosa	3.17	5.43	0.71	2.22	4.34
Truffle	7.57	6.55	7.25	5.30	5.26

In the dried state the wood-fiber and the nutritive-substance content is increased, as will be seen in the following table:—

Fungi and mushrooms.	Cellulose. Per cent.	Proteids. Per cent.	Carbohydrates. Per cent.	Assimilated nitrogen. Per cent.	Assimilated carbohydrates. Per cent.
Field mushroom	7.56	41.69	30.75	29.18	24.64
Boletus bulbosus	6.87	36.66	34.51	25.66	27.61
Morcella elata	5.50	28.48	37.72	19.94	29.94
Helvella lacunosa	5.63	25.22	43.30	17.65	34.64
Truffle	27.67	33.89	24.88	23.71	19.90

According to the above tables, quite a considerable amount of nutritive substances is contained in many fungi and mushrooms. Although the assimilation of the same is made difficult by the amount of cellulose they contain, this process is somewhat aided by the fact that a portion of the proteid content does not consist of protein compounds; there, nevertheless, remains quite considerable nutritive value. The following is a list of the most nourishing fungi, together with the number of calories furnished by them:—

Fungi and mushrooms.	Calories contained in 1000 grams.
Elaphomyces granulatus	2163
Truffle	495
Fistulina hepatica	393
Boletus bulbosus	369
Morchella elata	279
Cantharellus cibarius	290
Helvella lacunosa	295

The varieties containing the least cellulose are usually the most digestible. In these are included the field mushroom, *Helvella lacunosa, Morchella elata, Fistulina hepatica,* etc. In order to make them more digestible, the fungi must be thoroughly cooked during quite a long time, whereby a very good tasting juice is obtained. The long cooking sometimes removes substances which might prove injurious; therefore a long cooking, and then leaving the sauce unused, would be by far the best plan whenever there is the least doubt as to the kind and quality of the mushrooms. According to Lamie, prolonged cooking will render even the poisonous varieties innocuous, and other authors say that the same is the case when they have been placed in vinegar or salted. It is much the best, however, not to eat such suspicious varieties at all. Many rules have been given by which they can be recognized, such as the peculiar and unpleasant odor when they are cut open, the discoloration of the cut surfaces, and other peculiari-

ties. But for the inexperienced gatherer or purchaser these are insufficient and not always infallible.

The safest plan, in Austria, is to buy the mushrooms in the market, where they have been examined by the market inspectors.

In addition to their frequently high nutritive value fungi often contain other valuable substances, such as phosphorus and lecithin. The following is a list of a number of varieties, with their content of these substances, according to Lietz[1] :—

PHOSPHORUS AND LECITHIN CONTENT OF FUNGI.

Fungi.	Total phosphoric acid.	Lecithin.
Helvella lacunosa	3.08 per cent.	1.641 per cent.
Cantharellus lubœformis	1.41 "	1.335 "
Mushroom	4.25 "	0.935 "
Field mushroom	1.37 "	0.377 "
Bolelus bulbosus	1.54 "	0.583 "
German white truffle	1.61 "	0.381 "
Helvella crispa	1.67 "	1.388 "
Lactaria scrobiculala	1.78 "	0.786 "
Hygrophorus ficoides	2.18 "	1.399 "

Another valuable property of the fungi and mushrooms is that they contain considerable amounts of various nutrient salts. Some of them contain much iron—the truffle, for instance, which is rich in salts in general. The mineral-salt content of the truffle, which is really a plant growing in the earth, may depend upon the composition of the soil in which they grow. Besides the truffles the *Helvella lacunosa* and the *Boletus* varieties are also very rich in nutrient salts.

The following table shows that fungi are especially rich in lime and phosphorus, and also contain quite considerable amounts of iron :—

[1] After König.

NUTRIENT SALT CONTENT OF SEVERAL VARIETIES OF FUNGI, ACCORDING TO KOHLRAUCH AND LOESCHKE.

	Pure ash in dry substance.	Potash.	Soda.	Lime.	Magnesia.	Iron oxide.	Phosphoric acid.	Sulphuric acid.	Silicic acid.	Chlorine.
Field mushroom .	5.20	50.11	1.69	5.75	0.53	1.16	15.43	29.23	1.42	4.58
Truffle	8.69	54.21	1.61	4.95	2.34	6.51	32.96	1.17	1.14	0.16
Helvella lacunosa	9.03	50.40	2.30	0.78	1.27	1.00	39.10	1.58	1.09	0.89
Morcella elata ...	9.42	49.57	0.39	1.59	1.10	1.86	39.03	1.89	0.87	2.02
Bolelus varieties..	8.46	55.38	2.53	3.47	2.31	1.06	23.22	10.69		

When we consider the great nutritive value of the fungi and mushrooms, their content of important substances, such as lecithin, as well as of many nutrient salts, they must be regarded as an excellent food. Their use is to be particularly recommended as component of a vegetable diet, but a good stomach and intestine are required for their digestion.

(*k*) GREEN VEGETABLES.

1. *Concerning Vegetables Growing Above and In the Ground.*

When a vegetable grown above the ground, such as spinach, is cooked as it is, without the addition of any water, one will be surprised at the quantity of fluid that will gather in the cooking utensil. This is the water which is present in considerable quantities in spinach and all of the vegetables that are grown above ground; in fact, they consist principally of water: 80 to 92 per cent. It is for this reason that an animal which feeds upon leaves and green vegetables does not need to drink water; when rabbits and guinea-pigs are fed in this way they do not drink, but if they are fed upon grains they must have water. Very much the same thing is the case with man, and consequently in diabetes large quantities of green vegetables should be taken. Normal persons can also with such a diet prevent thirst in the summer; another advantage

is that the fluid in vegetables enters the circulation gradually, so that it is not suddenly overcharged, as it is when the liquid is taken all at once in the form of water or beer. In cases where the addition of large amounts of fluid is contraindicated, as in heart affections or arteriosclerosis, vegetables may prove beneficial, but care should be exercised in selecting those which do not cause flatulence.

The nutritive substances contained in the leaf vegetables grown above ground include only small amounts of nitrogen,—from 2 to 4 per cent.,—which, when we include the unripe leguminous vegetables, may amount to 7 per cent.,—also small quantities of sugar (up to 2 per cent.) and other carbohydrates, —6 to 10 per cent. in some varieties. Unfortunately the cellulose content is quite large, so that the assimilation is poorly accomplished. Since the process of cooking removes a considerable portion of these nutritive substances and also of the nutrient salts, the nourishing properties of these vegetables are greatly diminished; indeed, such leafy vegetables are less chosen for their nutritive value than for other desirable properties we shall now mention.

The following table by König (ii, p. 925) shows the nutrient content of various vegetables of this sort:—

	Analyses.	Water. Per cent.	Albumin-free substance. Per cent.	Fat. Per cent.	Sugar. Per cent.	Other albumin-free substances. Per cent.	Cellulose. Per cent.	Ash. Per cent.	Phosphoric acid. Per cent.	Organic sulphur. Per cent.	In the dry substance. Proteids. Per cent.	Nuclein-free extractives. Per cent.
Cauliflower	5	90.89	2.48	0.34	1.21	3.34	0.91	0.83	0.150	0.089	27.63	49.94
Butter cabbage	1	86.96	3.01	0.54	1.47	5.72	1.20	1.10	0.152	0.070	23.06	55.14
Winter cabbage	2	80.03	3.99	0.90	1.21	10.42	1.88	1.57	0.263	0.102	18.46	61.04
Brussels sprouts	2	85.63	4.83	0.46	....	6.22	1.57	1.29	0.282	0.138	33.44	47.22
Savoy cabbage	4	87.09	3.31	0.71	1.29	4.73	1.23	1.64	0.207	0.088	25.67	47.41
Red cabbage	1	90.06	1.83	0.19	1.74	4.12	1.29	0.77	1.112	0.062	18.44	58.95
White cabbage	8	90.11	1.83	0.18	1.92	3.13	1.65	1.18	0.125	0.038	18.50	51.06
Spinach	3	89.24	3.71	0.50	0.10	3.51	0.94	2.00	......	......	34.49	33.55
Asparagus		93.75	1.79	0.25	0.37	2.26	1.04	0.54	......	0.041	28.77	42.08
Green garden peas (unripe seeds)	5	77.67	6.59	0.52	12.43		1.94	0.85	0.331	0.054	29.51	55.66
Green puff beans (unripe seeds)	3	84.07	5.43	0.38	7.35		2.08	0.74	0.178	0.020	33.08	46.69
String beans (not dry, ripe)	7	88.75	2.72	0.14	1.16	5.44	1.18	0.61	0.146	0.039	24.25	58.66

The great quantity of nutrient salts contained in these vegetables plays a more important part than the nitrogen or carbohydrate content.

Head salad contains much lime, about 37.63 in the pure ash, and also much iron—5.31 per cent. Owing to their high content in alkaline salts, green vegetables exert a considerable influence upon the composition of the blood, which they alkalinize. In very acid urine, this increased alkalinity of the blood greatly diminishes the acidity, and with large quantities of such food the urine may even become alkaline. A similar result is brought about by the large amounts of organic acids which occur either in the free state or in combination with alkalies, and are converted into carbohydrate combinations by combustion in the body. The juice of head salad contains potassium citrate: tomato juice also contains mainly citric acid. The ash content of several varieties of leafy vegetables is as follows:—

Nutrient Salt Content of Several Varieties of Cabbage, According to König.[1]

	Potash. Per cent.	Soda. Per cent.	Lime. Per cent.	Magnesia. Per cent.	Iron oxide. Per cent.	Phosphoric acid. Per cent.	Sulphuric acid. Per cent.	Silicic acid. Per cent.	Chlorine. Per cent.
Cauliflower.....	26.37	10.24	18.68	2.30	0.30	13.08	11.41	12.84	6.07
White cabbage (outside leaves)	22.14	12.10	27.88	4.44	0.10	3.88	15.31	10.80	13.68
Hearts of white cabbage	37.82	14.42	9.36	3.52	0.15	12.30	15.46	......	6.97
Spinach	16.56	35.24	11.87	6.38	3.35	10.25	6.82	4.52	6.29
Head salad	17.63	7.54	14.68	6.14	5.31	9.19	3.76	8.14	7.65

In order, however, that the important nutrient salt content of such vegetables shall not be lost, a proper method of cooking is required. When boiled in water—especially pure

[1] König, ii, p. 927.

water—without salt, the nutrient salts are drawn out, and frequently this water is then thrown away. The best way would be to cook such vegetables in utensils in which the water does not come into contact with the vegetables, and where it is principally the steam which acts upon the food—as is the case with the Wolf cooking apparatus—or when the vegetables are steamed according to the English custom. In Austria and Hungary they are prepared with much browned butter and very little water, which is quite to the purpose, as very little of the nutrient salts is thus lost.

Proper cooking is all the more important for such foods, since the intestinal assimilation is dependent upon it. When some of the nutrient properties are lost in cooking, and others through the insufficient assimilation in the intestine, these foods lose much of their value.

The more raw fiber vegetables contain, the less they are assimilated in the intestine. Experiments were made by Rubner with curled Savoy cabbage and green beans in respect to their assimilation, with the result that of the harder portion of the Savoy cabbage 14.9 per cent. of the nitrogen and 15.4 per cent. of the carbohydrates were lost, and of the beans 15 per cent. of nitrogen and 15 per cent. of the carbohydrates of the hard portions remained unassimilated.

It is of the greatest importance that green vegetables be thoroughly cleansed before using them, since a number of bacteria and unclean substances of all kinds adhere to them. The thorough washing of the salads which are eaten raw is of the greatest importance. Worms are often found in carelessly cleaned vegetables. When not sufficiently cooked, tiny snails, which are sometimes found in vegetables, may prove injurious. In this way the green vegetables instead of benefiting the health may prove detrimental.

When well prepared and properly cooked, green vegetables may often be very useful as remedial herbs. We have already

shown that they increase the alkalinity of the blood; in this way affections like gout and diabetes, in which there is acidity of the blood, may be much benefited. We might add that, as remedial agents, vegetables—in addition to this important increase of alkalinity—exert, owing to their cellulose, a very favorable action upon the intestines, thus preventing or benefiting constipation. Since the most remote times many curative properties have been ascribed to green vegetables, and the medicinal treasures of the old masters of healing contained many of the vegetables now in use. In the progress of the science of medicine, with the painstaking experiments of the present day, their claims have been set aside. Nearly all of the green vegetables, however, have the property of alkalinizing the blood and improving the action of the bowels; the majority also have a more or less favorable effect upon diuresis, and some contain substances which stimulate the digestion. In this way they exert more of a curative action than almost any other food substance. In the diet of diabetics, gouty patients, and those suffering from arteriosclerosis, green vegetables occupy a first place.

As regards the very useful and nutritive salt content, it would be well if one could extract the juices of the vegetables as is done with fruits. Should the taste not prove very agreeable, other substances might be added, for instance a few drops of lemon juice, or whenever practicable a little of some other fruit syrup. These extracts could then be taken as curative substances. This would present the advantage that the indigestibility of certain vegetables need not at all be taken into account. The exclusion of certain substances and a thorough cleansing before the pressing out of the juices would be an obvious necessity. Since the nutrient value of such vegetables is rather limited to begin with, the nutrient salts would in this way be fully utilized.

We must, however, not overlook the fact that in addition

to their many good properties green vegetables also possess some undesirable ones. Some herbs, such as sorrel, contain much oxalic acid, and the alkalinizing property is also not always desirable, as for instance in phosphaturia. The indigestibility of certain vegetables must also be taken into account, as is the case with roots, stalks, etc., which contain much cellulose. The most easily digested are the tender fresh vegetables and those cultivated in greenhouses, and also in gardens. Those growing in the wild state—as is also the case with wild animals—are less tender, and often contain more pungent substances. These varieties, digested with difficulty, may be rendered more suitable for consumption by keeping them in dark places, as in a cellar from which the light is excluded; in this way, although they lose their color, the chlorophyll, the fibers become more tender. Thus, salad when raised in a cellar is very much more easily masticated and digested, and the taste is also less acrid.

Some vegetables, and in particular those of the cabbage family, cause considerable flatulence. Among these, cauliflower is probably the most easily digested. We may mention here that vegetables have the property of taking up a large amount of fat, their nutritive quality being thereby much increased.

We shall now refer to certain individual vegetables, although only the most important varieties, the scope of this work not permitting us to dwell upon all of them.

One of the most important of the leaf vegetables is spinach, which is in general very easily digested; for this it is necessary that the spinach be prepared as a smooth purée, and not served with the leaves entire, as is the custom in some countries, in which form it is less digestible.

Spinach very readily gives off its coloring matter, and is consequently well adapted for the coloring of soups, etc. It absorbs large amounts of fat, and tastes very good when goose-

fat is added to it, as was so often proven to his guests by the writer Alexander Dumas—who prepared it in person. It is said that spinach tastes better when warmed over. By the addition of eggs the nutritive value is increased. A very practical method and one of much dietetic value is to add the yolks of two eggs to the spinach, stirring them in; this also greatly improves the taste. There is scarcely any other vegetable which is so prized in the practice of dietetics as spinach, and in cures, as at Carlsbad, it plays an important rôle. It greatly favors the action of the bowels, and certainly induces less flatulence than most other vegetables of the cabbage group. But even so desirable an article of diet as spinach is not without its drawbacks. It is frequently the cause of oxalic acid formation. I have very often observed the presence of oxalic acid in the urine of my patients at Carlsbad. In healthy persons, of course, this is of no importance, especially in those who often show oxalic acid in the urine.

Much more oxalic acid—the largest amount contained in any vegetable—is present in sorrel, which fact should be taken into account when the latter is used. This vegetable has a very sour taste. It is best eaten in purée form. Sorrel sometimes causes intestinal or gastric disturbances when taken in combination with sour fruit.

Water cress also contains an acrid substance. It has long been credited with the property of stimulating the secretion of saliva and cleansing the mouth, for which reason it has often been used in ulcers of the mouth. Cress stimulates the appetite, and is often served with fine roasts. It is digested the most easily when taken in the form of a purée. This vegetable was in great favor among the ancient Persians, as well as the Greeks and Romans, not only as a food, but also as a medicinal agent. The name "santé du corps" (health of the body), which was given to it by the French, shows how greatly it was esteemed by them. It is an interesting fact that this vegetable,

which was first cultivated in Germany at Erfurt, was seen there by an officer of Napoleon's army named Cardon, who introduced it into France. In the latter country it is eaten in considerable amounts at almost every meal; in Austria and Germany, on the other hand, it is used comparatively seldom.

Water cress requires much water in order to thrive. It should be mentioned, however, that when the watery soil in which it grows becomes contaminated with drain water containing the bacilli of typhoid fever, as is not infrequently the case, it may transmit the disease. Cress is sometimes used for its medicinal properties. It contains important substances, such as iodine, iron, etc. Its juice is claimed by certain authors to be useful in many skin diseases: very stubborn cases of eczema are said to have been cured with it. In constipation it has a favorable action, and also stimulates the appetite.

Another vegetable which improves the appetite is parsley. It stimulates the sense of taste and helps the digestion; it is much used for soups, sauces, and as an addition to many foods that would seem rather tasteless without it. It also promotes the flow of urine and augments the perspiration. Apiol, which is used in menstrual disorders, hysteria, etc., is obtained from parsley.

A much-used vegetable is celery, which also has a stimulating action. As a remedial agent it is beneficial in flatulence, and for this purpose a kind of preserve is made from celery stalks. It is also a generally accepted fact, especially in the Latin countries, that celery exerts a stimulating effect upon sexual activity.

In some countries—as in England—celery is frequently eaten raw at the end of the meal. In this form it is certainly not very easily digested. In England and America it is also used as a salad; during my stay in America I often had occasion to take it mixed with grapes in a sort of mayonnaise.

Owing to a bitter substance contained in it, chicory also

has a favorable action upon the appetite. It is interesting to see with what avidity animals, especially pigs, will devour chicory growing wild. Probably their instinct tells them that it is a useful plant. The roots in particular are very bitter. Animals which feed upon these plants are thereby protected against skin diseases. Chicory has a strengthening influence upon weak animals. In some countries, as in Belgium, especially in Brussels and its vicinity, this plant is extensively cultivated. A special variety is raised there which, when kept in the dark, becomes more digestible, having tender fibers and also a finer taste; Brussels chicory is renowned for this reason. Owing to the bitter substance contained in it, chicory, when well cooked, has a favorable action upon the digestive processes, but if eaten as a salad it is very indigestible. When the roots have been dried, then roasted and finely ground, a well-known, although not universally liked, substitute for coffee is obtained. It is surprising that this substitute, which so frequently gives rise to much disappointment when a good cup of coffee is expected, should have been placed upon the market in the very country where generally the best coffee in Europe is drunk, viz., in Holland.

Endive is a variety of chicory which is even more bitter. It is cultivated chiefly in Holland. It contains 2.78 per cent. of nitrogen, 0.76 per cent. of sugar, 1.19 per cent. of other carbohydrates, and 0.82 per cent. of cellulose.

Two varieties of herbs have already been mentioned that are rich in oxalic acid; we shall now add rhubarb, which, like celery, is much used in England. Rhubarb is, however, not easily digested; owing to its acid content, it, like sorrel, very often has an unfavorable action upon the stomach. Owing to the acid contained in it, its use should be forbidden in kidney affections and particularly in oxaluria. According to König, it contains 0.82 per cent. of nitrogen, 0.18 per cent. of sugar, and 0.52 per cent. of cellulose, together with 0.78 per cent. of

oxalic acid in the fresh substance and 14.23 per cent. in the dry substance, and malic acid in the stalks and leaf-stems; 3.28 per cent. of sugar is also contained in the dry substance.

A very delicious vegetable, and probably one of the most prized of all, is asparagus. As a nourishing food it is not, to be sure, of very great value, since it only contains 0.47 per cent. of sugar, 2.80 per cent. of other carbohydrates, and a rather large amount—1.54 per cent.—of cellulose. The young shoots are most easily digested, as are also the tips and upper portions of the asparagus; the lower portion contains much fiber and is therefore indigestible.

Already in the time of the ancient Greeks, asparagus was held in great esteem among high livers, as stated by Theophrastos, and its high price even now practically restricts its use to such circles. It is a luxury among vegetables, having almost no nutritive value. When added to other foods, as in a mixture of eggs with asparagus tips, it improves the taste, stimulates the appetite, and is, in this way, useful. Asparagus contains a considerable amount of iron, which constitutes about 3.38 per cent. of the ash. It is also rich in certain other nutrient salts—containing, according to König,[1] in the ash 24.04 per cent. of potash, 17.07 per cent. of soda, 10.85 per cent. of lime, 4.32 per cent. of magnesia, 3.38 per cent. of iron oxide, 18.57 per cent. of phosphoric acid, 6.18 per cent. of sulphuric acid, and 10.9 per cent. of silicic acid. It very often contains even much more potash than the amount stated.

Asparagus contains an amido-compound—asparagin—to which an influence upon glycogen formation is ascribed, and which is said to exert a favorable action in diabetes. It should be remembered, however, that asparagus greatly increases the flow of urine, and, when diabetics pass very much urine, asparagus is not to be recommended for them. The same may be said of its use in kidney affections, catarrh of the bladder,

[1] After König, ii, p. 924.

strangury, and diseases of the prostate. When asparagus has been eaten the urine has a peculiar, unpleasant odor, but when a few drops of turpentine are added this is changed into an agreeable violet perfume.

Asparagus when freshly cut—particularly in May—has rather an agreeable aroma, and, even though cut for some little time, it will preserve this aroma when kept in a damp place, standing in sand with the tips up. The property of promoting sexual activity has frequently been ascribed to it. Asparagus tips in syrup were used by Broussais to quiet cardiac action.

Asparagus tastes much the best when freshly cut. It soon loses its flavor, and when used canned or bottled is not nearly so good. It is pretty rich in extractives and promotes the formation of uric acid, as it contains 0.25 per cent. of purin bodies. It is consequently not well adapted for gouty patients.

In the treatment of gout, obesity, and often in diabetes, the above-named vegetables are useful, since, because of their bulk, they appease hunger without greatly increasing metabolism, as they contain only small amounts of nutritive substances. Some varieties contain more of these than others, but besides these so much cellulose that the intestinal juices cannot well act upon them. They are consequently not readily taken up into the blood. The oyster plant belongs to this class. It contains 80.39 per cent. of water, only 1.09 per cent. of protein, but 2.29 per cent. of sugar and 12.61 per cent. of other carbohydrates. The cellulose content is large, amounting to 2.27 per cent. In the dry substance this vegetable contains 5.31 per cent. of protein and 75.97 per cent. carbohydrates. Notwithstanding the considerable carbohydrate content, it is not injurious for diabetics, since it contains much inulin, the primary substance of fruit-sugar, which is frequently much better borne. This vegetable is also poorly assimilated, which is usually an advantage in diabetes. After its use I have frequently noticed

quite normal looking fragments of oyster plant in the feces, which would indicate that it should be classed among the least nutritious vegetables. Of the 14.81 per cent. of carbohydrates only 12.44 per cent. are assimilated (König). It has still another advantage, namely, that it is very satisfying; when fried in plenty of butter it is a very palatable food. For gouty patients and obese persons, it would be a desirable food, since not very much of it can be eaten, but in obesity not much butter should be added. The young shoots of hops are also a very good food.

Artichokes are very rich in carbohydrates, especially in the lower portions of the vegetable. They contain 15 per cent. of carbohydrate, of which 0.57 per cent. is glucose and 2.84 per cent. dextrose. The nitrogen content is 1.68 per cent. The lower part of the vegetable[1] contains 0.21 per cent. glucose and 2.06 per cent. dextrose, with 2.54 per cent. of protein.

The lower portion of the artichoke is that chiefly used. It may be prepared in the form of a purée, and is easily digested in this way. We may here mention the rather large content of tannic acid, which turns the knife black.

The cabbage family is poorer in carbohydrates, but contains more protein than the above-named vegetables, sometimes as much as 9 per cent. or even more. Their content of nutrient salts is even more important. The various kinds of cabbage occupy a prominent place among our vegetable foods, but have the disadvantage that they are, in general, not easily digested. The top of the cauliflower is the best in this connection, and when it is well cooked it almost melts in the mouth. The lower part is more difficult to digest, and the upper portion is all that should be eaten. Cauliflower, like all the cabbage variety, has the property of causing considerable flatulence; indeed, this class of vegetable does so more than almost any other food.

[1] König, ii, p. 925.

When the ground has been well fertilized, cauliflower sometimes attains an almost incredible size. Specimens of this sort can be seen in the neighborhood of Frankfort and Nassau. Cauliflower is rich in potash, lime, phosphorus (13 per cent.), with 12.81 per cent. of silicic acid in the ash.

A rather easily digested variety of cabbage is Brussels sprouts; the finest specimens are found in Belgium, which country is, so to speak, really one large vegetable garden. Here and in Holland probably the best vegetables in the world are grown. Brussels sprouts are a very interesting variety among the cabbages; the plant shoots up like a tree among its brothers in the vegetable patch, and clustering around its stalk are found the little rose-like flowers. In the German language it is called "rose cabbage." The taste, like that of the cauliflower, is very pleasant, and it is quite nourishing, since it contains 4.81 per cent. of protein. In this connection, however, it should be remembered that a considerable part of this vegetable is not made up of protein combinations and is consequently not assimilated. Of the 6.22 per cent. of carbohydrates only about 5.22 per cent. is absorbed. But, even so, Brussels sprouts are nourishing and easily digested, and probably cause rather less flatulence than the other varieties of cabbage. It would be desirable to have this very useful vegetable cultivated to a greater extent in Austria. The nutritive properties of both the cauliflower and Brussels sprouts are greatly enhanced by the customary addition of a good deal of butter, of which Brussels sprouts in particular take up a considerable quantity. For diabetics the cabbage family are excellent vegetables, and cauliflower in particular should occupy a prominent place in the bill of fare of diabetic patients.

The red and white cabbages are poorer in nutritive properties than the above-named varieties. They contain less than 2 per cent. of protein, with 2 per cent. of sugar, and 3 to 4 per cent. other carbohydrates. They must be well cooked, for

they are hard to digest; when thoroughly cooked, red cabbage is somewhat improved in this respect. Since these two vegetables are not nourishing, it is rather necessary to add some fat to them. They contain quite an amount of the nutritive salts. The outer leaves of white cabbage contain much lime (27.88 per cent.), and the heart contains 37.82 per cent. of potash and 12.30 per cent. of phosphorus. Neither the taste nor the digestibility of white cabbage is calculated to make it a popular vegetable. It is only made so when, by a process of fermentation, it has been converted into sauerkraut. In this way it becomes a useful vegetable, which we shall now consider.

2. *The Advantages of Sauerkraut.*

Sauerkraut is by some considered very indigestible. This is, however, not the case when it has been properly prepared. It is made by adding 3 per cent. of common salt to white cabbage, which withdraws a quantity of fluid from the latter. All varieties of cabbage contain quite a considerable quantity of fluid. Heavy weights are laid upon the cabbage after packing it in kegs, and so much fluid is pressed out that the cabbage fairly bathes in it. When kept at a temperature of 11° C. it ferments by means of yeast and bacteria; the sugar is fermented, and lactic acid is formed. This acts upon the fibers of the cabbage, and after a time they are softened. When it is very thoroughly cooked the fibers are still further softened, thus making out of this indigestible vegetable the much more digestible sauerkraut. It has, further, the advantage due to its lactic acid of exerting a kind of disinfecting process in the intestine. In many cases of intestinal catarrh, especially when large quantities of decomposition products are present, sauerkraut may have a favorable action, and I have several times observed very good results following its use. It might also be added that the pleasant sour taste has a stimulating effect

upon the appetite, especially in cases where the stomach is in good condition. This applies also to cases in which the loss of appetite is due to such influences as depressed spirits, overwork, etc., in which cases, also, no gastric juice is secreted. Here the pleasantly piquant taste of sauerkraut may have a beneficial effect, and in several such cases I have had good results when one or two tablespoonfuls of sauerkraut were taken at the beginning of the meal. In order, however, that these beneficial effects may follow, care should be taken not to throw away all of the juice and then serve the sauerkraut quite dry, as is unfortunately frequently the case in restaurants and even in private houses. In this way the useful lactic acid content is diminished; this juice also has a very refreshing and pleasant taste. When cleanliness is exercised in the preparation of sauerkraut this lactic-acid-laden juice would be a very useful drink, just as is the juice of pickled cucumbers. I found that when during the hot summer days I had no appetite I could stimulate it by taking a little of this juice. Of course, the salt has something to do with this. It is necessary that not more than 3 per cent. of salt be added. I have also noted that the addition of sour milk or cream or jogurt to the cooked sauerkraut was very useful, its nutritive value, which is otherwise not very great, being thereby increased. The same is the case when considerable butter is added. When the sauerkraut is of itself too sour, it may be improved by the addition of sweet milk, or by adding some tomato sauce, which is rather sweet. It could also be mixed with a little sugar.

Tomato sauerkraut is a very excellent and palatable food. It is not hard to digest, especially when sufficiently cooked, and it can be made even more digestible when it is cooked a second time. Many people are of the opinion that both sauerkraut and tomato sauerkraut taste better when warmed over a day or two after the first cooking; at all events they are certainly more easily digested in this way.

Like many other good things of this world sauerkraut—the tomato sauerkraut rather less—has a defect. It causes flatulence in many persons, but it has at the same time a favorable effect upon the bowel movements. The salt content would be a disadvantage in cases of kidney diseases.

3. *Tubers, Husk Vegetables, and Vegetable Fruits.*

Although the varieties of vegetables described under this head do not as a general thing possess the same curative properties as those treated in the previous chapter, they are, on the other hand, more nutritious, owing to their greater starch content. The assimilation products absorbed from the air by the leaves are deposited in the root tubers in the form of starch, and it is just these products which we shall now discuss as food. The tuberous roots most rich in starch, such as the tropical varieties and the potatoes, have already been described. We shall now consider the turnips and other tubers of this class.

The turnips most frequently used are no doubt the yellow turnips. They contain in the natural substance, according to König, 1.18 per cent. proteins, 0.12 per cent. fat, 4.03 per cent. of sugar, with 3 per cent. of other carbohydrates and 1.62 per cent. of cellulose. In the dry substance they contain 8.91 per cent. of protein, 68.48 per cent. of carbohydrate, and 1.43 per cent. nitrogen.

Of nutrient salts the yellow turnip[1] contains much lime—11.34 per cent.—and 36.93 per cent. potash, 21.17 per cent. soda, 1.01 per cent. iron, 0.45 per cent. sulphur; thus, there is much potash and soda in addition to the considerable amount of lime.

While their high content of certain salts would lead us to consider yellow turnips as a useful vegetable, they are unfor-

[1] König, ii, p. 913.

tunately not well assimilated by the intestine, as Rubner states that a considerable portion of the nutritive substance is eliminated unused. The yellow turnip promotes the action of the bowels. The "red turnip"—the beet—is principally used as a salad. According to König, i, p. 772, it contains 0.54 per cent. of sugar and 9.02 per cent. of other carbohydrates; those gathered in the beginning of August contain 1.37 per cent. of protein, and beets in general contain 1.05 per cent. of cellulose. We here give, according to König, ii, p. 917, a list of the various root vegetables, with their nutrient content:—

	Water. Per cent.	Protein. Per cent.	Fat. Per cent.	Sugar. Per cent.	Carbohydrate. Per cent.	Cellulose. Per cent.	Ash. Per cent.	Phosphoric acid. Per cent.	Organic substances. Per cent.
Small beets........	88.05	1.50	0.10	0.50	7.78	1.07	1.00	0.090	0.008
Small yellow turnips	88.84	1.07	0.21	1.58	6.59	0.98	0.73	0.131	0.015
Teltower turnips...	81.90	3.52	0.14	1.24	10.10	1.82	1.28	0.190	0.079
Kohlrabi............	85.89	2.87	0.21	0.38	7.80	1.68	1.17	0.127	0.069
Large radishes (black and white)	86.92	1.92	0.11	1.53	6.90	1.55	1.07	0.132	0.072
Small radishes	93.34	1.23	0.15	0.88	2.91	0.75	0.74	0.073	0.017
Oyster plant........	80.39	1.04	0.50	2.19	12.67	2.27	0.99	0.120	0.041
Celery	84.09	1.48	0.39	0.77	11.03	1.40	0.84	0.740	0.210
Horseradish........	76.72	2.73	0.35	trace	15.89	2.78	1.53	0.199	0.078

	Potash. Per cent.	Soda. Per cent.	Lime. Per cent.	Magnesia. Per cent.	Iron oxide Per cent.	Phosphorus. Per cent.	Sulphur. Per cent.	Silicic acid. Per cent.	Common salt. Per cent.
Kohlrabi.........	35.31	6.53	10.97	6.84	3.02	21.90	8.84	2.84	4.94
Large radish (black and white)	21.98	3.75	8.78	3.53	1.16	41.12	7.71	8.17	4.90
Small radish	32.00	21.14	14.94	2.60	2.34	10.86	6.46	0.91	9.14
Horseradish......	30.76	3.96	8.23	2.91	1.94	7.75	30.79	12.72	0.94

A variety of turnip which is not much used, although deserving of more attention, is the white turnip. It probably contains the most water of any: 93 to 95 per cent. It is quite rich in nutrient salts, 45 per cent. potash and 10.60 per cent.

lime, but, owing to its indigestibility and poor assimilation, quite a good deal of these salts is lost. The digestibility and general value of white turnips may be increased by salting them and allowing them to ferment, as is also done with the white cabbage. When cooked they may be mixed with sour milk or cream, and also with tomato sauce. Like the yellow turnips, they likewise have a favorable action upon the bowels.

Kohlrabi is much more used than white turnips. This variety of turnip has a sweetish taste, but does not contain very much sugar, only 0.38 per cent., with 7.80 per cent. of carbohydrates, of which a certain amount, owing to its chemical composition and poor assimilation, need not be taken into account. Kohlrabi contains 1.68 per cent. of cellulose, rather more than does white cabbage, and, while the total carbohydrate content amounts to 8.47 per cent., only 6.87 per cent. is assimilated. Very nearly one-half this amount is fruit-sugar, which is well tolerated by many diabetics. For this reason kohlrabi may be recommended in diabetes. What is here said of the kohlrabi is applicable to many other vegetables.

Less as a vegetable, but more as a stimulant for the appetite, the large radishes—both black and white—have come into use. They do excite the appetite, but are of themselves very indigestible. They should consequently not be used by persons having weak stomachs. For healthy persons with good stomachs they are an excellent food at the beginning of a meal, especially the smaller and more tender radishes.

Horseradish is rather to be regarded as a pungent flavoring substance than as a vegetable, which should only be used by perfectly healthy persons as a stimulant for the appetite in combination with other foods. Even healthy persons would do well to use it but sparingly. Like the onion, the horseradish should only be used to improve the taste of certain foods. Both of these vegetables may have an injurious action upon the kidneys owing to the pungent substances they contain.

The various radishes contain a pungent substance, an ethereal oil similar to that contained in mustard. The smaller varieties of radishes are more easily digested than the larger ones, but when not well masticated and salivated will cause disagreeable eructations. In summer the large radish will be found useful when the appetite may for various reasons not be quite up to the mark. It should first be well salted, which will draw out some of its fluid content, and should then be left covered up for a time until more juice has been extracted. In this way the fibers are somewhat softened, and are rendered more digestible. People possessed of a good stomach can eat quite a good deal of it at the beginning of a meal, and yet have plenty of appetite for the rest of the food. It is not without nutritive qualities, since it contains 8.47 per cent. of carbohydrate, but there is a large amount of fiber, so only 7 per cent. of the carbohydrate is assimilated. Small quantities may be taken by diabetics, but the smaller varieties, which contain only 3.79 per cent. of carbohydrates, would be better; of these, but 3.18 per cent. is assimilated.

The tomato, with its pleasant acid taste,—the name tomato comes from the Aztec (Mexico) word tomatl,[1]—is another agreeable addition to various other foods. It also has a certain nutritive value, since, according to Bailey and Lodema,[2] it contains 4 to 5 per cent. of sugar. In this country it is principally the juice which is used; it is put up in bottles in the summer, and is then used throughout the year, to flavor other foods, such as rice, potatoes, cabbage, etc. When a considerable quantity of tomato is used the nutritive properties are naturally improved. Owing to its content in citric and malonic acid,—0.7 to 0.8 per cent.,—the tomato may be regarded as a healthful food.

In some countries, and particularly in England, America,

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[1] The ancient Mexicans already cultivated the tomato.

[2] Centralblatt für Agrikulturchemie, 1890, p. 493.

Spain, and Italy, this vegetable is also eaten raw as a salad. The meat is tender, and when this alone is eaten it is easily digested; when the seeds are also used they may have a somewhat beneficial action, as do figs, by exercising a sort of massage upon the intestinal mucous membrane. As a disadvantageous feature it may be mentioned that tomato contains a small quantity of oxalic acid.

When prepared as an acid vegetable the cucumber may also prove useful. In general, it is not easily digested, but when it undergoes a process of fermentation in salt water its tissues are softened by the action of the lactic acid which is thus formed, so that it becomes somewhat more digestible. The salted cucumber pickle would therefore probably be the most healthful mode of using the cucumber, except in the cases in which salt is to be avoided, as in kidney affections.

The cucumber is not rich in nutritive substances. It contains only 1.09 per cent. of protein, but the carbohydrates are rather better represented, there being 1.12 per cent. of sugar and 1.09 per cent. of other carbohydrates. Large cucumbers contain more sugar and are therefore better adapted for preserving. According to König,[1] the nutrient salt content of the cucumber is in the ash 51.71 per cent. of potash, 4.19 per cent. soda, 6.97 per cent. of lime, 0.75 per cent. iron, 13.10 per cent. phosphorus, and a considerable amount of chlorine, 9.16 per cent.

The pumpkin is likewise prepared as a sour vegetable in some countries, as in Hungary. It is also used like cabbage in combination with various dishes prepared from flour, such as the "strudel." In my opinion, this vegetable is undeservedly neglected as a food, for it contains a considerable quantity of nutritive substance. It only contains 1.10 per cent. of protein, but over 6 per cent. of carbohydrate, of which 1.29 per cent. is in the form of sugar, and 5.16 per cent. in other carbohy-

[1] *Loc. cit.*, ii, p. 922.

drates. The small pumpkin is worthy of much greater attention than is accorded it at present, since it contains as much as 6 per cent. of sugar (4 per cent. grape-sugar and 1.50 per cent. cane-sugar). It is therefore a nutritious vegetable, and its taste is very agreeable. Of the nutrient salts it contains much phosphorus, up to 33 per cent. in the ash, and much soda and lime, 21.13 and 7.79 per cent.; it is very poor in common salt.

The melon is much more used and liked than the pumpkin, although some varieties of the former are less nutritious than the dried pumpkin. According to König, the melon contains 0.84 per cent. protein, 3.41 per cent. sugar, and up to 3 per cent. of other carbohydrates; the American sugarmelon contains 8 to 12 per cent. of sugar, together with the other carbohydrates.[1] The watermelon has 0.61 per cent. of protein, 4.21 per cent. sugar, and 1.07 per cent. of other carbohydrates. When we drink melon juice we absorb 4.14 per cent. of invert-sugar and 0.17 to 0.19 per ct. of malic acid. Notwithstanding the fact that the cellulose content of the melon is not great,—1.06 per cent.,—it is nevertheless hard to digest, as is also the pumpkin, especially when not quite ripe. Both of them have laxative properties, but they may also have an irritating effect on the intestine, thus causing diarrhea and intestinal catarrh. The juice of the watermelon is very refreshing in the heat of summer, and in some countries, as in Turkey, Spain, and Hungary, this fruit is much eaten. The negroes in the United States are particularly fond of watermelon. When there is catarrh of the intestine or a tendency to diarrhea melon is a dangerous food, and when cholera is prevalent the people are warned against its use.

To a much greater extent than the above-named vegetables, green peas form a nourishing, and also a very palatable, food. They contain (according to König, i, p. 781) 9.50 per cent. of sugar and other carbohydrates and 5.54 per cent. of

[1] König, i, p. 781.

nitrogen, with 1.61 per cent. of cellulose. Green peas should be classed among the most nutritious and most easily digested vegetables, especially when they are young and tender; they contain but little cellulose. When they are older they are more nourishing, but also contain more of the latter substance, and are digested with more difficulty, both in the stomach and intestine. Peas should not be given to small children, who, as I have frequently observed, simply swallow them whole, in which form they are also passed out through the intestine, after having caused irritation of the latter. The garden variety of green peas may contain as much as 62.45 per cent. of sugar and other carbohydrates, of which only 10.40 per cent. is assimilated.

String beans are less nourishing and more indigestible. They consist principally of inosite, and, as this substance does not increase the sugar in the urine in diabetes, string beans represent one of the most desirable among the green vegetables for patients suffering from that disease. Of the 6.60 per cent. of carbohydrates only about 5.54 per cent. is assimilated. Green string beans contain much less sugar than peas, only about 1.16 per cent.

4. *Concerning Winter Vegetables, Canned and Preserved Vegetables, and Salads.*

In our climate but very few fresh vegetables can be had in winter. A few varieties of cabbage, like the red cabbage and possibly some few others, are to be had when the winter is not yet well advanced. Brussels sprouts, chicory and endive, etc., may often be obtained late in the autumn. Even in the middle of winter one may have fresh vegetables by growing them in a cellar, in which case one first spreads out a layer of earth, then some manure, and on the top another layer of soil. Such vegetables as do not absolutely require light can be made to grow well in a cellar, and some kinds, like the chicory and

endive, even lose a part of their bitter taste. Certain fungi, like the mushrooms, can be planted in a cellar. The same is the case with salad, and usually the vegetables raised in this way are rather more easily digested, although they are poorer in some of the salts—iron, for instance. Naturally, the salad grown in the open is much better, particularly because of its high content of iron, 5.31 per cent., and other nutrient salts. It also contains 37.63 per cent. of potash, 7.54 per cent. of soda, the rather large amount of 14.68 per cent. of lime, 6.19 per cent. of magnesia, 9.19 per cent. of phosphorus, 8.14 per cent. of silicic acid, and 7.65 per cent. of chlorine.[1]

Salad thus grown also contains acids, like citric acid, in combination with the potash. The amount of nutrient substance is very small, and it has less of protein (1.92 per cent.) than the field salad (2 per cent.), but is generally more easily digested. The sugar content is only 0.11 per cent., and the other carbohydrates are likewise poorly represented, for which reason it may be freely eaten by diabetics. It is also useful owing to the salts contained in it, which have an alkalinizing action. Head salad when well prepared with good ingredients is a very good food in summer. It is more healthful when mixed with lemon juice than with vinegar. Nature has already provided it with some citric acid, and when a good vegetable oil, like olive oil, is added its nutritive value, which is really slight, is considerably increased.

In the heat of summer the fresh acid taste of such salad increases the appetite, and it is a useful adjunct to meat foods. We have already referred to other varieties of salad, like the endive, chicory, cress, etc., as well as tomatoes and cucumbers. As a salad vegetable we may also mention the olive, which would prove very nutritious, owing to the oil contained in it, were it not for the fact that it is very indigestible. In some countries, as in France, Italy, and Spain, the olive is eaten at

[1] König, ii, p. 927.

the beginning of a meal, as a "hors d'œuvre," for the purpose of stimulating the appetite. The olive contains barely 1 per cent. of protein, but rather more carbohydrate (9 per cent.) and a great deal of fat (18 per cent.). In salads it is especially important to use pure oil, with preferably lemon juice or the best vinegar.

Olive salad can always be used during the winter, the summer vegetables being also available when preserved. Naturally, preserved vegetables are never as good as fresh ones; the fine flavor is impaired, but the nutritive substances and nutrient salts remain when the vegetables are kept, together with the juice in which they have been cooked. The vegetable must first be cooked and then be placed in sterilized bottles or large jars. The neck is then hermetically closed with rubber bands between the lids and bottles, in much the same way as in the Weck process. This is probably the best method of keeping the vegetables. In the Weck method the vegetables are cooked in the bottles. In this way the majority of summer vegetables may be at our disposal in the winter, although they will have lost some of their taste. Unfortunately bought preserved vegetables often have the disadvantage that injurious substances have been added in order to give them a fine appearance; thus, the peas and cucumbers have a wonderful green color. This is usually obtained by the addition of a very small quantity of copper sulphate or blue vitriol, and, although it is stated that experiments have shown that this is not in the least harmful to normal persons, the statement should not be depended upon. As we have shown in another portion of this work, the natural condition is always greatly to be preferred in everything, and, although such additions may not be directly fatal to life or to the health, the accumulation of such minimal quantities of injurious agents continued during a long time would probably prove injurious to the majority of persons. Even the vinegar in which some vegetables, such as cucumbers,

beets, etc., are pickled may often be injurious, owing to the mineral acids contained in it. The mixed pickles of commerce are also very indigestible.

(*l*) The Fruit Diet.

1. *Fruit as a Food, and the Nutritive Value of the Various Varieties.*

We have so far discussed the nutritive values of various foods; we shall now consider a class of foods in which the nutritive value is not the principal factor, but which are endowed with another peculiarity, namely: the refreshing properties of their juices. Providence has so arranged that just in the very hottest regions the most juicy fruits are to be found, so that the faint and thirsty man may be refreshed by them. This is not only accomplished by the quantity of water contained in such fruits, but also by a series of organic acids and important salts which are represented in considerable amounts in their juices. Some fruits are richer in iron and lime than are many other foods. The refreshing action is not only the result of the organic acids above mentioned, but is also induced by the large quantities of sugar contained in some fruits. This makes them valuable foods, and dried figs, dates, and bananas are so nutritious because of the sugar contained in them that some vegetarians live only upon fruits. Such a diet might, it is true, contain much more of the carbohydrates than is required for our daily ration, but a corresponding amount of the important nutrient substance, albumin, is missing, without which we cannot really thrive. The majority of fruits are very poor in albumin, and the quantity which is contained in them, as is also the case with the carbohydrates, cannot be well assimilated by our digestive organs, since the cellulose prevents the action of the digestive fluids. It is for this reason that some kinds of fruits are more digestible and better assimilated

when they are cooked, since this process softens the cellulose. Unfortunately, however, considerable of the important nutrient salts are thus lost, much being contained in the skins of the fruits. We have here an analogy to the cereals, in which important salts are also lost by the removal of the outer portions. When in peeling fruits the upper layer of the fruit-meat is removed, flavoring substances are lost, in which just this portion of the fruit is very rich. True vegetarians, therefore, and especially those living upon fruits alone, do not pare the fruits, and eat them raw. Since for such a diet a very healthy stomach is required, it can certainly not become a general habit. As we have already said in referring to a vegetable diet, a diet of this sort followed for a time may undoubtedly present great advantages, but to adopt it for a permanent use would give rise to great dangers for our health. On the other hand, the taking of a large quantity of easily digested fruit during several weeks, as a fruit or grape cure, may be very beneficial, since, as we shall show later on, it has a very favorable influence upon many conditions. A healthy person should always eat fruit in the raw state. For those who are ill or delicate, and particularly for those whose stomachs and intestines do not properly carry on their functions, the fruit should be stewed. When cooked, fruit, to be sure, loses not only a portion of the nutrient salts, but also of the carbohydrates, as a considerable part of the sugar is cooked out into the sauce. When diabetics eat stewed fruit they should never eat the juice, which contains much sugar. In the cases in which the juice is eaten, the carbohydrates which have been lost are again replaced. The rather large quantity of acid has, like the fiber content, a very unfavorable action upon the digestion, particularly when the fruit is unripe; consequently only such as is fully ripe should be eaten.

Negligence in this respect, particularly in the case of children, will give rise to serious intestinal disturbances. When

the fruit ripens, the quantity of acid and cellulose is materially lessened. In some fruits which are gathered in an unripe condition and kept for some time, the sugar content is increased owing to a ferment contained in them; thus, very ripe bananas contain a great deal of sugar. In dried fruits such as bananas, figs, dates, etc., the sugar content is sometimes exceedingly great.

The fine aroma, the perfume of the fruit, is caused by ethereal oils which are principally contained in the cells of the skins. Just as rice, as has already been explained, loses its taste when transported without the skin, so apples and pears lose all of their delicate aroma and flavor when they are left for a time without their skins. The organic acids are principally malic, tartaric, citric, and tannic. When too much of these is present the digestion suffers, and when too little the taste suffers. A small quantity of acid in some fruits may have a stimulating effect upon the appetite, thus starting the process of digestion.

The sugar and acid contents of various fruits, according to König,[1] are as follows:—

Fruits.	Sugar content. Per cent.	Free acid. Per cent.
Apples	8.55	0.70
Pears	8.61	0.20
Prunes	7.76	0.92
Peaches	8.11	0.72
Apricots	6.66	1.05
Cherries	9.95	0.72
Grapes	14.95	0.77
Strawberries	6.24	1.10
Raspberries	4.29	1.45
Huckleberries	5.24	1.37
Blackberries	5.72	0.77
Mulberries	9.19	1.86
Gooseberries	7.93	1.37
Currants	6.44	2.24
Red bilberries	1.53	
Medlars	10.57	2.34
Oranges	5.65	1.35

[1] König: "Chemie der menschlichen Nahrungs- und Genussmittel," ii, p. 1489. In addition to the sugar content given other carbohydrates are present in small quantities.

The sugar content of a fruit may often be fairly well determined by the outward appearance of the skin. Truelle, after many years' observation, found that fruits with yellow skins contain much sugar and have a very penetrating odor; with a red skin they contain a medium quantity of sugar and have a pleasant, delicate perfume; with a reddish-brown skin, very much sugar and but little perfume. As a general thing the fruits having a glossy skin are very juicy and have the most pronounced odors.

In order to obtain fruit with a high content of sugar and only very little acid it must be left hanging on the tree until absolutely ripe. The later it is gathered, the stronger will be the perfume.

According to Balland,[1] the constituents of various fruits are as follows:—

Fruits.	Water content. Per cent.	Nitrogen. Per cent.	Fat. Per cent.	Sugar. Per cent.	Other carbo-hydrates. Per cent.	Cellulose. Per cent.	Salts. Per cent.
Apricots	87.70	0.93	0.12	8.10	1.60	1.41	0.64
Pineapple in cans	75.70	0.60	0.06	18.40	4.35	0.57	0.24
Bananas, peeled	73.40	1.44	0.09	21.90	2.03	1.22	0.92
Figs, fresh	84.80	0.79	0.22	8.30	3.85	1.23	0.71
Strawberries	85.60	0.31	0.03	3.30	0.80	0.36	0.21
Raspberries	82.60	1.60	1.11	7.14	3.04	3.91	0.60
Medlars, without acid	92.60	0.61	0.07	2.90	1.40	0.23	0.69
Peaches	86.60	0.48	0.48	6.70	3.63	1.19	0.51
Pears	88.50	0.04	0.04	6.40	3.73	1.12	0.17
Apples	82.60	0.06	0.06	8.90	5.51	1.21	0.28

J. König gives the following average composition of certain fruits, based on a series of analyses:—

[1] Balland: *Loc. cit.*, p. 252.

Fruits.	Water. Per cent.	Nitrogen. Per cent.	Sugar. Per cent.	Other carbo-hydrates. Per cent.	Cellulose. Per cent.	Carbon. Per cent.
Prunes	81.18	0.78	6.15	4.92	5.41	0.85
Gooseberries	85.74	0.78	7.03	1.91	3.52	1.15
Cherries	79.82	0.67	10.24	1.76	6.07	0.91
Strawberries	87.66	0.57	6.28	6.48	2.32	0.93
Currants	84.77	0.51	6.18	0.90	4.57	1.15

The sugar found in fruits is partly grape-sugar and partly fruit-sugar—about one-half of the latter; they also contain some cane-sugar. The nutrient salt content of fruits is quite important; on the opposite page we present a list of the same according to König.

Certain varieties of fruits contain appreciable quantities of manganese. Manganese oxide is found in the ash of

Plums, fleshy portions	0.23 per cent.
Plums, whole fruit	0.39 per cent.
Apricots, fleshy portions	0.24 per cent.
Apricots, whole fruit	0.37 per cent.
Cherries	0.82 per cent.
Grapes	0.24 per cent.
Huckleberries	0.02 per cent.
Figs	0.21 per cent.

2. *Concerning Apples, Apple Juice, Apple Tea, Cider. Other Fruits having Seeds and Pits.*

Some persons never go to bed without eating one or two apples, being of the opinion that they cause them to sleep better. I shall not here enter into the question as to whether this idea is well founded or not, although it is no doubt possible that by thus eating apples before retiring another hygienic result is achieved; the acids contained in the apples have a certain antiseptic influence upon the micro-organisms present in the buccal

NUTRIENT SALTS IN VARIOUS PARED FRUITS[1] (IN SEVERAL INSTANCES THE ENTIRE FRUIT).

Kinds of fruits.	Pure ash in the dry substance. Per cent.	Potash. Per cent.	Soda. Per cent.	Lime. Per cent.	Magnesia. Per cent.	Iron oxide. Per cent.	Phosphoric acid. Per cent.	Sulphuric acid. Per cent.	Silicic acid. Per cent.	Chlorine. Per cent.
Apples	1.75	40.85	.....	8.85	5.05	.....	9.70			
Pears	1.62	58.60	.....	6.50	5.60	.....	11.80			
Prunes	2.38	57.50	.....	6.40	3.80	.....	11.60			
Plums	2.08	69.36	2.30	4.05	4.86	1.02	12.95	2.46	2.73	0.34
Apricots	4.21	61.80	10.71	2.95	3.10	0.87	11.04	2.55	5.29	0.48
Cherries, whole	2.35	57.45	4.45	5.85	5.47	1.55	15.64	5.43	5.08	
Cherries, peeled	2.25	50.10	.....	7.00	5.20	.....	12.85			
Grapes, whole	3.95	51.99	3.68	6.91	3.19	1.19	21.27	5.00	3.37	1.82
Grape-skins	4.03	44.22	1.87	21.02	5.73	1.54	17.62	3.68	3.01	0.62
Strawberries, whole fruit	3.40	49.24	4.71	12.30	6.40	2.89	13.06	3.15	6.01	1.69
Gooseberries, whole fruit	3.39	45.48	6.92	12.53	4.72	2.56	19.82	5.84	2.58	0.75
Huckleberries, whole fruit	2.87	57.11	5.16	7.96	6.11	1.12	17.38	3.11	0.89	
Currants, fleshy portion only	4.03	40.73	.....	9.70	6.30	.....	17.00			
Figs, whole fruit	2.92	55.83	2.38	10.90	5.60	2.19	12.76	3.91	4.31	2.05
Oranges, whole fruit	2.73	47.09	2.84	22.81	5.72	1.36	12.63	5.14	1.28	0.81
Lemons, whole fruit	3.22	45.13	2.73	30.24	5.15	0.77	13.62	3.08	0.75	0.48

1 König, ii, p. 59.

cavity and in the throat, and thus prevent inflammatory processes in the throat, to which persons who have large tonsils are particularly subject. The acids which are sometimes present in very large quantities in apples—especially the sour varieties—render them rather injurious for the stomach, and persons who are subject to acidity of the stomach should never eat apples. The sweet and juicy varieties are preferable, and those which ripen early in the summer are more easily digested, since they contain less cellulose,—we see here the similarity existing between the fruits and vegetables, and even animals if we compare the fiber with the connective tissue,—while the older fruits, especially the dried varieties, have a great deal of this fiber. The Tyrolese apples are very easily digested, especially the "Köstlichen" varieties, and in Meran "apple cures" may be taken in the late summer or early in the autumn. According to personal experience, it is possible to eat 5 or 6 or even more of the "Köstlichen" apples without experiencing the least difficulty. They almost melt in the mouth. Apples may exert an alkalinizing effect, owing to the organic acids contained in them, which are converted into carbonate compounds by the combustion process, and it has been observed by Garrod, Weiss, and others that they are very beneficial in gout. It is also said that in regions where many apples are eaten, and where cider is drunk, renal calculi rarely occur. This may be due to the infrequency of uric acid concretions.

Apples are also beneficial in diabetes. There is no other fruit which may be so unstintedly allowed for diabetics with the exception of the berry fruits. Cooked apples are to be preferred, since a portion of the sugar is lost in cooking. Even one or two raw apples per day can, however, be allowed for many diabetic patients. It is a mistake to think that any number of sour apples may also be permitted in diabetes; it should be remembered that the acid taste merely disguises the sugar, but does not remove it, just as when giving sour milk to diabetics

one must consider that, together with the lactic acid, the sugar is still present in the milk. Sour apples are not to be recommended for weak stomachs, because they usually contain much cellulose. Juicy, soft apples are the best, especially those which can be somewhat mashed or squeezed in by the fingers; the credit of being the very best of all must be conceded to the Tyrolese variety already mentioned. Canadian apples, particularly those from the province of British Columbia, and also those from the State of Oregon in the United States, are very excellent juicy varieties, probably owing to climatic properties and those of the soil. Apples thrive best where the earth contains sugar-forming substances such as potash and phosphorus, and we must fertilize the soil with these substances if we wish to produce a fine quality of fruit.

Apples are more digestible when stewed. In England and in America it is customary to bake them, and "baked apples" in which the cores have been previously removed are very palatable and not hard to digest. When prepared as apple sauce they are most easily digested, but that made of very sour apples is not adapted for all stomachs. The juice of apples may also be used as a very agreeable sort of tea; according to Monteuis, this is made by cutting a large apple into 8 pieces, and pouring over it one-half liter of hot water; it is then left on the edge of the fire for about two hours. To improve the taste 2 or 3 slices of orange or lemon are added, with 5 or 6 pieces of domino or lump sugar. This is a very agreeable beverage for invalids, but healthy persons may also drink it instead of tea, as it tastes very good. It is to be served hot, and one obtains in this way, besides the juice, the full aroma of the apple, since the skin is left on. The juice of the apple is a very beneficial drink; we shall refer to the fruit juices later on, but will merely give here the average composition of apple juice in one liter of juice:—

Sugar	126 grams.
Acids	2 grams.
Tannic acid	3 grams.
Pectin bodies	9 grams.

To obtain the juice the apples are crushed in machines, and it is then extracted by pressure. From this juice cider is made, and when fermentation has taken place it becomes apple wine; as the latter contains 5 to 10 per cent. of alcohol, it has the same disadvantageous properties as alcoholic drinks in general. We recommend cider, as it has an excellent effect upon diuresis and defecation, and prevents the formation of uric acid concretions. Cider is a favorite drink among the Normans and Bretons, and the sparkling, though still unfermented, cider has a very agreeable taste; the same is not the case when the fermentation process has been completed, for like most fruit wines it does not taste as good as the wine made from grapes. The fruit wines have no advantage over the latter; in fact, the contrary is the case.

In certain parts of Austria, and in Germany in particular, cider is much liked. A beverage resembling it is made from pears, "cidre de poires" (pear cider), which after fermentation contains more alcohol than apple wine. Much sweeter ciders are made from pears than from apples, and this high sugar content causes the greater content of alcohol. Pear juice does not taste as good as apple juice; it contains 126 to 148 grams of sugar per liter, and less tannic acid in general than apple juice. In my country pear cider is not much used, but in Normandy and Brittany much of it is drunk, like the more agreeable apple cider. Pears often contain more juice than apples. The Salzburg pears are exceedingly juicy and have a delicious taste; the same is the case with the Kaiser pears and several other varieties. In general, however, pears are not easily digested, as they contain hard, gritty, and indigestible granules. Some varieties, when kept for a long time, get very soft,—almost like butter,—the amount of acids and cellulose being diminished by a fermentative action, and the grape-sugar is converted into the more agreeable fruit-sugar; they are then rather more digestible. Most of the varieties of pears are

rendered more digestible by cooking, and some, like the American canned pears, almost melt in the mouth. Although they have a most pleasant taste, the same objection applies to them as to preserved fruits in general. It is much the best to put up the fruit at home, cooking them in the Weck appliances. Fruits preserved in glass in their own juice with the addition of a little cane-sugar are the most healthful.

Apricots and peaches should only be eaten when perfectly ripe, in which manner they are easily digested. Since very ripe and soft fruit does not cook well, hard fruit is usually taken for this purpose, and thus it frequently happens that soft, ripe fruit is more easily digested raw than fruit that is cooked. Among peaches the free-stone varieties are best digested; the cling stones are not to be recommended for weak stomachs. The finest and most juicy peaches are no doubt those grown in Hungary and in many parts of Austria; apples and pears thrive best in Bohemia, and large numbers of very fine apples are shipped from there into Germany.

In Hungary, Bosnia, and Servia, and also the south of France, are produced many plums, which fruit plays so important a part as a remedy for constipation; dried plums, or prunes, in particular, possess this laxative property. For this purpose the large California plums as well as the Bordeaux plums are the best; they must, however, first be soaked in water, and the skins should be removed before they are eaten, since they are hard to digest owing to the amount of raw fiber they contain.

Dried plums are most healthful when cooked, as the raw fiber is softened by the cooking, and is much more easily digested.

Fresh raw plums, prunes, and green gages are well digested when they are ripe and tender. Prunes contain considerable boric acid, and Windisch found 0.17 per cent. of this in the juice;—also a certain amount of salicylic acid, which,

though present in some fruits,—to be discussed later on,—is not injurious to our bodies when taken in such minute quantities; indeed, it might rather serve some curative purpose. We consider plums and prunes, even when taken in large quantities, as more healthful than green gages; the former have a favorable action upon the bowels.

3. *Berries.*

It is a peculiar fact that the most delicious and appetizing garden strawberries attain their finest development when such repulsive substances as soft, fatty cow and stable manure is used in fertilizing the ground. Strawberries require nitrogen, phosphorus, and potash, and these are easiest furnished to them in this way. Fortunately, as has been shown by Remlinger and Noury, injurious bacterial substances cannot penetrate from the manure into the interior of vegetables and fruits. If, however, any one for esthetic reasons should object to this origin, or, better said, the assistance of such malodorous drainage substances, in growing the berries (unfortunately, estheticism ceases in animal functions and habits) he must confine himself to the wild strawberries. The wild strawberry usually has a much finer aroma, as is generally the case with all the wild varieties of berries. In the majority of fruits the aroma only lasts for a short time after they have been gathered, and strawberries taste much better in the woods than two days later at the fruit dealers'. Ripe berries are quite easily digested, but in those not quite ripe the great number of small seeds may have an irritating action. The large, ripe, garden variety is also easily digested, but, for weak stomachs and where there are intestinal disturbances, strawberries had best be forbidden. In gout, as has been shown by the experiments of Weiss in the laboratory of Bunge, strawberries may prove very beneficial, and in England strawberry cures have been

successfully resorted to. There, especially in London, great quantities of these berries are in the markets; Denmark is also rich in strawberries, and they sell for a very low price in Copenhagen; in one of the fruit-selling establishments in that city, the "Jordbaer" (strawberries) were named Andersen after the proprietor. In summer the strawberries are eaten in Denmark with the truly exquisite, thick, Danish cream, "Jordbaer met flöde," and are most palatable. Strawberries are a valuable fruit for diabetics and arteriosclerotics, since they are not rich in sugar. The small seeds may exert a mild stimulating action upon the bowels. Their beneficial action in gout is not sufficiently explained by the small amount of salicylic acid,—2 to 3 milligrams to the liter,—although it must not be forgotten that similar substances when combined with others, as in the body or in the foods, may act in homeopathic doses. As has been stated by Aron,[1] very minimum quantities of certain substances may cause rashes or eruption through chemical reactions occurring in the body. Raspberries are, as a general thing, much more indigestible than strawberries, owing to the large seeds; but they also have a most agreeable aroma. The most indigestible of all berries are currants and gooseberries, the latter being the poorest in that respect. The considerable amount of cellulose in the skins of the latter and the seeds and the cellulose of the fleshy portions of the not overripe berries are conducive to this result. The juice of very ripe currants and gooseberries has a very pleasant taste. According to Hebebrand, 100 cubic centimeters of gooseberry juice contains 1 milligram of boric acid. The berries endowed with the principal therapeutic properties are no doubt huckleberries, these properties having been brought to light by Winternitz. Blueberries, or huckleberries, have a very favorable action in intestinal affections, chronic catarrh, and diar-

[1] Aron: *Loc. cit.*

rhea. They have a mild astringent action, and in this respect exert a beneficial action upon the mucous membranes. They are also excellent in chronic inflammations of the throat. They decrease inflammatory processes and have a certain antiseptic action, and the pharmacopeias of some cities provide for very useful preparations to be made from these berries. The digestibility of these berries is not so very poor, since they contain no irritating seeds, and I have ascertained that the eating of more than a pint of berries is not followed by any digestive disturbances. Even more easily digested are the mulberries which grow wild in great profusion in some regions, particularly in Hungary. This useful and very agreeable fruit should really be more planted and enjoyed. The mulberry tree is also most useful in the silkworm industry, and should, if only for this reason, be cultivated in large numbers. Blackberries are very indigestible, even when quite ripe, owing to their many large seeds. The best results are to be obtained, from these and other indigestible berries, with their juices, as we shall show later on. Bilberries are likewise not very readily digested, as they contain much acid. The best of these berries among the European varieties are those grown in Sweden, called "Lingon," for the exploitation of which a stock company has been formed in Göttenburg, which exports them to the value of several millions of "krone" per year. The American variety (cranberry) is much larger, but not so fine in taste. The bilberry is especially valuable for diabetics, since there is scarcely any other fruit which contains so little sugar.

4. *The Benefit to be Derived from the Daily Use of Cherries.*

When we particularly recommend cherries, and even the daily use of the same, it is because of several beneficial properties peculiar to this fruit. Among all the fruits used by us, cherries—with the exception of grapes only—contain the

greatest amount of sugar (10 to 12 per cent.). Since one is able to eat a considerable number of cherries, especially of those with tender skins which are in the markets in May and June, without feeling any uncomfortable pressure in the stomach, one is not only indulging in a most agreeable fruit,—not to say the very best of the spring fruits,—but in a nutritious article of diet as well. It would not be difficult to eat as much as 1 kilo per day, when divided among the several meals; 400 or more calories are thus obtained. There is no other fruit, with the exception of grapes, of which so many can be tolerated as of luscious spring cherries, which are easily digested because they are exceedingly juicy and have a thin skin. Later in the season they are more indigestible, particularly the tough variety. It would be difficult to find a similar quantity of valuble nutrient salts in other fruits; very few contain as much of the alkalinizing salts, potash, and lime, and also of iron and phosphoric acid, as do cherries. Correspondingly large quantities of other edible fruits rich in nutritive salts would not so easily benefit us and would have an injurious effect on the stomach, since they are, like apricots, for instance, very indigestible. According to my experience, excepting grapes, no fruit "cure" can be so successfully carried out as with juicy spring cherries. Without in the least diminishing the appetite for the next repast, one can eat during a meal ¼ kilo (½ pound) or more. For a delicate stomach it is better not to swallow the skins, although the aroma and certain valuable substances are contained in them. When the stomach is delicate these cures may also be taken by using cherry juice, which, with the exception of that of the agriot, has the best taste of any fruit juice. Cherries, especially those which reach the markets during May and June in Holland and Denmark, the best cherry countries of the world (these two countries and their seafaring populations resemble each other in many respects), are not only the most palatable of fruits, but

they are also a very healthful food. They belong to the class of fruits which are useful in gout "cures," as has been shown by Weiss in Bunge's laboratory. According to my own observations in many persons, I would add that cherries are one of the fruits which have the best action upon the bowels. They should be eaten just before retiring as well as after the mid-day and evening meals. The times are past when it was customary to strictly forbid the use of all fruits at Carlsbad. I advise my patients, particularly those suffering from gout, constipation, or arteriosclerosis, to eat cherries, and also advocate the use of grapes, but not shortly before or after the drinking of the spring waters. Dried cherries have a greater action upon the bowels than even fresh cherries or dried prunes. Dried cherries should be much more frequently used, especially by vegetarians. They, as is in fact the case with all dried fruits, contain more sugar than fresh cherries, and I believe them to be more easily digested than dried plums. In Denmark, especially, I found the very best quality of fleshy dried cherries. Naturally, the nutritive value of such cherries is not inconsiderable. Vegetarians, particularly those living strictly upon fruits, should eat dried fruits of all kinds as often as possible.

5. *Grapes and their Advantages. Hothouse Grapes (Frankenthal, Colman, Alicante).*

The observation was made long ago by Niemeyer that persons who consume two or three pounds of grapes daily grew fat, and Pliny stated that foxes living on the wine hills and—according to their habit—stealing the grapes grew fat very rapidly. This does not surprise us, when we consider that grapes contain a considerable quantity of sugar, 14 to 18 and even up to 20 per cent. When therefore about 2 pounds of grapes are eaten daily, as much as 300 grams of sugar are absorbed, and, when in addition meat and other nourishing

foods are taken, a person can very easily gain in weight. If, however, he wished to live principally or exclusively upon grapes, he would be badly off, since they contain but little albumin. According to König, fresh grapes contain, on the average, the following constituents:—

Water. Per cent.	Albuminous products. Per cent.	Pectin bodies. Per cent.	Sugar. Per cent.	Free acids. Per cent.	Seeds. Per cent.	Ash. Per cent.
78.17	0.59	1.96	14.36	0.79	3.60	0.53

Grape- and fruit- sugar is found in considerable quantities in ripe grapes, as in other fruits; in the unripe fruit there is more fruit-sugar. The grapes of the South, as in Spain (Andalusia) and Portugal, contain much sugar, and from them a very alcoholic wine can be therefore made. Grapes, owing to their high sugar content and the tartaric acid and tannin contained in them, their aroma, etc., are especially adapted for the manufacture of wine. Other fruits, like apples and pears, also contain considerable sugar; but as they likewise contain much malic acid, the wine obtained from them cannot be compared with that made of grapes. Considerable amounts of nutrient salts are also present in grapes. As shown in the analysis previously given, they are rich in the tartrates of potassium and calcium, as well as in the phosphates and sulphates of these metals.

In consequence of the great sugar content, the tartaric acid, and the salts, grapes have a laxative action, and they also act favorably upon the diuresis. It is therefore a good habit to eat a certain quantity of good ripe grapes daily after the midday and evening meal during the grape season, in order that they may act upon the bowels. The decided sugar content may also have a favorable action upon intestinal putrefaction. In order that grapes be healthful, they should be perfectly ripe and of unquestionable origin. Those having a fine skin, much juice, and small seeds are greatly preferred. The Hungarian grapes are of this kind. The Italian grapes often have very

thick skins, large seeds and very little juice; the Spanish grapes also have very thick skins, but in Valencia I ate a red variety of a long, oval shape which had a very sweet taste. Generally speaking, these southern varieties are not so juicy, but are sweeter,—a peculiarity due no doubt to the long-continued action and heat of the sun's rays.

In Austria the Meran (Tyrol), Baden, and Vöslau varieties are the best; in Germany the Rhein region, Baden, Würtemberg, and Mayence are celebrated for their grapes. Before grapes are eaten they should be washed in water in order to remove any copper sulphate which may have been sprinkled on them. The skins and seeds must not be swallowed, as they are not beneficial for the digestion. A few seeds would do no harm; they would, on the contrary, have a rather favorable massage-like action upon a sluggish intestine. The large seeds of some kinds of grapes would, however, be very bad for children. The little daughter of a family from Kirn, near Kreuznach, who were my patients at Carlsbad, ate, during the month of October, some hothouse grapes of which she swallowed the seeds; several months later she had colic every day and became much run down, until one day after having taken a very energetic purgative these seeds were expelled. During all these months the child had positively not eaten any grapes. Grape-lovers can obtain them in winter, in the hothouse varieties which are exported in large quantities from Belgium. Those most industrious and commercial people—the Belgians—have since several centuries, in Oulart, near Brussels, as also in Drooge Bosch and other places, an enormous number of greenhouses extending over kilometers and kilometers of ground, and these Belgian vines produce most excellent grapes. The best varieties are, first, the Frankenthaler, which have a very fine skin and not very large seeds and have a delicious taste. They contain a great deal of juice. Then come the Colman grapes; for my taste I prefer the latter

because they are more fleshy and have a very pleasant taste; the skin is also quite thin. The black, or Alicante, grapes, which have a thick skin, are probably the least fine; they also have considerable juice, but it is not sweet,—in fact, quite sour. The Colman variety is very meaty, but has less juice. The Frankenthaler are the most expensive and the Alicante the cheapest. It is really very inexpensive to eat grapes in Belgium at times when in other countries they are not to be had,—in November and December. The medium quality cost from 80 centimes to 1 franc (18 to 20 cents) and the best quality from 1.50 to 2 francs (30 to 40 cents) per pound. The grapes of the Belgian vines are of a much finer quality and aroma when they have been transplanted into Hungarian soil, as I have seen in the results obtained by the Belgian-Hungarian colony at Vàcz, near Budapest.

6. *Concerning the Advantages of the Grape Cure.*

Cajus Plinius already called attention to the value of grapes in many conditions of disease. The fact that they really do have such an action is shown by the statements made in the previous chapter. Since grapes have a stimulating effect upon the intestinal walls, they may induce a daily bowel movement in chronic intestinal constipation and in chronic intestinal catarrh with constipation; in cases of intestinal catarrh with diarrhea and abnormal putrefaction their antiseptic action may come into play. Owing to the high content of sugar, grapes cause acid fermentation—in the same way as do large amounts of carbohydrates—by means of which a decided disinfection of the intestine is accomplished through the agency of the lactic acid produced. Injurious decomposition products are thus destroyed. Owing to this property, as well as through the diminished viscidity of the blood induced, especially in a chiefly vegetarian diet, the grape cure may also

be very useful in a great many cases of arteriosclerosis. A decided diminution of very high blood-pressure was observed in such cures. Favorable results have also been reported, principally by French authors, in many cases of chronic kidney diseases. In gout, obesity, and emphysema, and also in many skin affections accompanying decomposition processes in the intestines, very favorable results were obtained. In diseases of the liver and in gallstones I advise a grape cure in the autumn, following the Carlsbad cure. The quantity to be taken daily is from 1 to 2 kilos, beginning with a small quantity and gradually increasing. The grapes are to be taken in the morning on an empty stomach, then one hour before both the midday and evening meals. That walking in the open air, which can be so agreeably accomplished in lovely Meran, with its wonderful climate, materially assists the cure can be readily understood; walking also plays an important rôle in other cures. According to my own experience, in spending weeks at a time in Meran, I know that large quantities of grapes, from 1 to 2 kilos, also have a very beneficial action upon a healthy person, especially when the juicy and tender-skinned variety to be had in Meran is taken. It is important, however, that during this cure certain dietetic restrictions be observed; foods having an irritating action upon the intestine must not be taken, the use of tobacco and alcohol must be restricted, and beer should be as much as possible avoided. The mouth should always be washed after eating large quantities of grapes; otherwise inflammation of the mucous membrane may set in, and the teeth may be injured. The length of the cure is from four to six weeks. The most popular resorts for the grape cures are Meran and Montreux and several other places on the Lake of Geneva, both on the Swiss and the Savoy shores of the lake.

7. The Advantages of Fruit Juices, Marmalades, and Jellies.

By simple prohibition it is not possible to successfully combat alcoholism. One must provide for the people who suffer from thirst in the summer, and who do not like to drink water—unfortunately, there are many such—a refreshing drink which will quench their thirsts. For this there is probably nothing more suitable and to the purpose than a drink of fruit juice. This would also have the advantage that, even though taken in large quantities, it would not be injurious, which can certainly not be said of alcoholic drinks. The fruit juices have a certain curative action in the body because of the organic acids contained in them, which quench the thirst more satisfactorily than almost any other substance, and because of their nutritive salt content. These, like the ethereal essences which so greatly affect the flavor and aroma of the fruit, are largely contained in the skins, which are usually thrown away; the skins are especially rich in iron and soda. The best kinds of fruit juices, those of the agriot and cherry, and of apples and huckleberries, have an indescribable aroma. According to J. König,[1] the amount of sugar, acids, and of important salts contained in certain fruit juices are as follows:—

In 100 cubic centimeters are contained

Fruit juices.	Invert-sugar. Gr.	Cane-sugar. Gr.	Acids. Gr.	Tannins precipitated by alkalies. Gr.	Ash. Gr.	Potash. Gr.	Phosphoric acid. Gr.
Apple juice	9.43	3.11	0.321	0.115	0.44	0.209	0.019
Cherry "	12.81		0.753	0.088	0.45	0.097	0.021
Strawberry juice....	5.33		1.040	Pectin 0.560	0.64	0.097	0.026
Raspberry "	5.33		1.846	" 0.960	0.50	0.086	0.032
Huckleberry "	6.27		1.130	......	0.29		
Gooseberry "	6.12		1.650	0.061	0.27		
Currant "	8.35		2.920	Pectin 0.754	0.59	0.140	0.036
Bilberry "	8.57		2.200	0.224	0.30		
Peach "	3.85		0.684	Pectin 0.760	0.47	0.076	0.046

[1] König: "Chemie der Nahrungsmittel," ii, p. 965.

The above table shows that certain fruit juices, as, for example, that of the cherry, contain quite considerable quantities of nutritive substances. In fevers these fruit juices are very beneficial, as the nourishment to be obtained from them is perhaps the only one that can be tolerated. Their high content of acids and salts makes them perhaps even more advantageous than the fruits themselves. They have a thinning effect upon the blood, thus diminishing its viscidity, and are consequently an excellent drink for arteriosclerotics, and all the more so since alcohol is here absolutely contraindicated. I have found that these fruit juices have a stimulating action upon the bowels when taken in considerable quantities. The uric acid eliminating and alkalinizing properties of fruit juices are even greater than in the fruit; so their use is indicated in gout. I have obtained good results with huckleberry juice in chronic intestinal catarrh with frequent diarrhea.

Diuresis is likewise favorably affected. Of well-made fruit juices made exclusively from fresh fruits, large quantities are well tolerated by persons in good health; I am fond of taking in summer the "Ceres" fruit juices made in a factory in Bohemia, not far from Carlsbad. I found the apple, cherry, and huckleberry juices the best, and sometimes took a pint or even more daily. In cases of hyperacidity of the stomach I would forbid the use of some of them, especially those made from apples and bilberries; in such cases fruits and fruit juices are frequently not well tolerated. In constipation, etc., I obtained the best results by the use of grape, cherry, and agriot juices.

For diabetics those made of fruits poor in sugar, such as the bilberry and huckleberry, without the addition of any sugar, give good results, especially since, on account of the dryness of the mouth, such patients are constantly craving something to drink. It is of course necessary that these fruit juices be made under conditions of especial cleanliness. They

are made by removing the stems and seeds, then mashing and squeezing out the fruit. Some cane-sugar is then added, and the product is sterilized and put into sterilized bottles, which are hermetically sealed. When the bottles are opened the contents will keep only one or two days, after which fermentation sets in. This proves that no antiseptic substances for the prevention of fermentation are contained in the syrups. There is probably nothing else in which falsification is so easily practicable as in the manufacture of fruit juices and marmalades. The sugar is often replaced by saccharin, and boric and salicylic acids, etc., are added as preservative agents. These are injurious for the kidneys, as these drinks of themselves have a diuretic action, and such substances cause irritation of the kidneys. Fruit syrups made in this way are more harmful than beneficial.

When the fruits are cooked, after the stems, seeds, and skins have been removed, marmalades are made. We use principally that made from plums ("powidl"). It is much the best to always make these marmalades at home, as those which are bought often contain more sugar than fruit.

8. *Chestnuts and Fat-containing Fruits, with Remarks Concerning Vegetable Fats.*

We are now concerned with the most complete vegetable foods, *i.e.*, most complete as regards their nutritious components, since these fruits contain considerable quantities of each of the three main groups of nutritive substances,—albumin, carbohydrates, and fats. The albumin, which is generally but poorly represented in fruits, is quite plentiful in these; the shelled groundnut contains as much as 30 per cent., but here again it is assimilated only with difficulty. Vegetarians living only upon fruits and nuts must have an ironclad stomach and intestine, for through habit they seem to tolerate such foods

far better than other people. They must also be blessed with very good teeth, foods of this kind requiring much mastication. But however well masticated they may be—even into a fine pulp—they are often not well borne and assimilated. Of the high carbohydrate content of the chestnut, for instance, which closely approaches that of the cereals, a large portion is lost in the intestine. These fruits contain the largest amount of fat of any of the vegetable products. The digestibility of these fats is exceeded by those of animal origin; although it is generally stated that vegetable fats are as easily digested as the animal fats, yet I have always found that after having ingested vegetable fats, even of the very best sorts, acid eructations are apt to be induced. It should be mentioned that the majority of vegetable fats contain larger amounts of free fatty acids than those of animal origin. The best fat for cooking is butter, and no vegetable fat can ever approach or equal it in regard to digestibility. The cocoanut, among the fat-furnishing fruits, contains a large amount of free fatty acids—from the kernel or "copra" of this nut oil is extracted. According to Salkowski,[1] linseed oil contains 3.45 per cent. of free fatty acid, and cottonseed oil only 0.19 per cent.—probably the least amount present in any of this class of products. The olive oil used for salads, etc., and frequently employed for cooking in the South, contains 1.17 per cent. of free fatty acid.

Following is, according to J. König, the average chemical composition of several fat-containing fruits, such as chestnuts:—

[1] Cited after König, ii, p. 109.

	Water. Per cent.	Protein. Per cent.	Fat. Per cent.	Carbohydrate. Per cent.	Cellulose. Per cent.	Ash. Per cent.
English walnuts	7.11	15.57	57.43	13.08	4.59	3.12
Hazelnuts	7.11	17.41	62.60	7.22	3.17	2.49
Sweet almonds	6.02	23.49	53.02	7.84	6.51	2.12
Chestnuts	7.34	10.76	2.90	73.04	2.99	2.97
Groundnuts	6.95	27.65	45.80	16.75	2.11	2.64
Pistachio nuts[1]	7.40	21.70	51.10	14.00	2.50	
Cocoanut	5.81	8.88	67.00	12.44	....	1.80
" milk	91.17	0.38	0.11	traces.	4.42	raw sugar.

In the dry substance are contained:—

	Protein. Per cent.	Fat. Per cent.
English walnuts	16.99	61.87
Hazelnuts	18.73	67.39
Almonds	24.99	56.42
Chestnuts	11.61	
Groundnuts	29.31	49.22
Cocoanuts	9.73	71.13

The nutrient salts present in chestnuts comprise, according to E. Wolff:—

Potash. Per cent.	Soda. Per cent.	Lime. Per cent.	Magnesia. Per cent.	Iron oxide. Per cent.	Phosphoric acid. Per cent.	Silicic acid. Per cent.	Chlorine. Per cent.
56.69	7.12	3.87	7.41	0.14	18.5	1.54	0.52

We may gather, from the above table, how very nutritious these seed fruits are; their consistency is unfortunately such, however, that they are hard to digest. Even when chestnuts —which contain so much carbohydrate material (up to 73 per cent.)—are ground to a fine powder, as it is done in France and Corsica, they are not capable of ready assimilation. I have frequently noticed in the feces a considerable amount of the chestnuts which had been previously ingested, even when well masticated or taken in the form of a purée.

[1] From a table by Hutchison, *loc. cit.*, p. 260.

If, therefore, in the south of France and in Corsica a certain portion of the population live during the winter chiefly upon foods made from chestnut flour and from the nuts themselves, and remain quite healthy and robust, it must be supposed that the digestion and assimilation of this variety of food are improved by constant use. For us, however, chestnuts, even when taken in the most advantageous way—in the purée form, so frequently used as an accompaniment to fine game and venison—constitute a very indigestible food. Whoever wishes to indulge in roasted chestnuts must have a good stomach. Even candied chestnuts (*marrons glacés*) are only suitable for the best of digestions. There is probably no other country in which there are so many chestnut trees as in Corsica; the amount of wealth represented in these trees for that comparatively poor island is shown by the fact that only a few years ago chestnuts aggregating in value 5 millions of francs were exported. Unfortunately, many of these very useful trees are now being sacrificed; factories have been erected for obtaining the tannin from them. Another wound inflicted upon agriculture by the manufacturing industries!

After the chestnuts, walnuts are most used with us,—hazelnuts not so much. Nuts constitute a very palatable food, and true vegetarians, particularly those living solely upon fruit, could not well get along without them. They furnish a considerable quantity of albumin, and also much fat. Owing to the quantity of fat, and unfortunately also of cellulose, they are very indigestible, even when finely chopped. They are therefore best adapted for use in other foods, particularly cakes and pastry. In Austria a much-liked dish, potato noodles with chopped nuts, is very appetizing. Fresh nuts are rather more easily digested than old, dried ones. The fatty varieties are also apt to become rancid when old, and are consequently not adapted for sensitive stomachs. Certain food products are made from finely ground nuts—nuttose, for instance—with

the aid of which the vegetarian kitchen is able to prepare very palatable and nourishing dishes. A very excellent nut which I first ate in a vegetarian restaurant in London is the Sapucian nut, a Brazilian variety. I consider it more digestible than nuts in general. I may also mention that nuts are rich in phosphorus, the ash containing nearly 44 per cent. of it. The nutrient salt content of nuts is given by König as follows:—

Potash. Per cent.	Soda. Per cent.	Lime. Per cent.	Magnesia. Per cent.	Iron oxide. Per cent.	Phosphoric acid. Per cent.
31.11	2.34	8.80	13.07	1.32	43.70

Hazelnuts are also rich in phosphorus, for, according to Balland, they contain in the fresh substance 0.35 per cent. phosphorus and 0.81 per cent. phosphoric acid. Hazelnuts are possibly even more indigestible than walnuts. Groundnuts (peanuts) from the Congo, which I often ate, seemed to be rather more easily digested. They form a sort of middle substance between leguminous vegetables and hazelnuts; they grow in pods resembling those of the pea, which grow very near the ground. The nut itself looks somewhat like our hazelnut. I found the taste more agreeable than the latter, and could tolerate more of them. According to Balland's analysis, groundnuts are also quite rich in phosphorus. They contain in the fresh substance 0.44 per cent., with 1.02 per cent. of phosphoric acid. Their chemical composition is as follows, according to Balland:—

	Water. Per cent.	Protein. Per cent.	Fat. Per cent.	Carbohydrate. Per cent.	Cellulose. Per cent.	Ash. Per cent.
Minimum	4.80	20.19	40.75	8.37	1.85	1.20
Maximum	8.00	30.24	50.50	21.11	5.15	4.20

Other similar nuts are likewise rich in phosphorus, *e.g.*, the Indian kemiri nut. Jebbink found in them 1.79 per cent.

of phosphoric acid. Among the oily varieties of nuts, I consider the pistachio as the most digestible, and one can eat quite a number of them.

Almonds belong to the indigestible varieties; the oil obtained from them is valuable, as is also that of the cocoanut, which contains, according to Salkowski, 3 per cent. free fatty acid. The cocoanut has a property which is much appreciated —it is said to be very beneficial in cases where there are intestinal worms. Many kinds of nuts which contain much fat have a stimulating action upon the bowel movements, as do fats in general when taken in considerable quantities. Mithridates and Pliny ascribed to nuts the property of immunizing against poisons. It might also be mentioned in this connection that larger quantities of alcohol can be tolerated when many nuts are eaten, possibly because its absorption is rendered more difficult. This might perhaps also explain the opinions of the ancient authors above mentioned.

9. *Tropical Fruits and their Advantages.*

Galenus stated that the guardians of vineyards all grew fat because they ate so many figs and grapes. This will be readily understood when we consider how nourishing these fruits are; the property which especially characterizes figs and tropical fruits in general is the great amount of sugar they contain, which in the dried fruits is sometimes simply enormous; so that they would amply suffice for the entire amount of carbohydrate required per day. Furthermore there is also much less acid in dried fruits; so their sweetness is not in any way diminished by the latter, as is the case in the other fruits. The fig is one of the southern fruits most used by us; in the fresh state it is very juicy and has a very pleasant taste. The quantity of little seeds contained in figs does less harm in the digestion than is the case with berries. Figs have a stimulat-

ing effect upon the bowels both in the fresh and the dried state, as these minute seeds exert a slight mechanical irritation. Fresh figs are easily digested, but not the dried ones, which contain much cellulose—7.82 per cent., according to Balland. He gives their composition as follows:—

	Protein. Per cent.	Fat. Per cent.	Sugar. Per cent.	Other carbohydrates. Per cent.	Cellulose. Per cent.	Ash. Per cent.
Fresh figs	0.79	0 32	48.30	3.85	1.23	0.21
Dried figs	2.36	2.10	48.40	5.27	7.82	3.15

We see by the above that dried figs are a most nourishing food. In studying the Koran, I found allusion to this fact—in the "Surat al Tin." According to the commentaries of Sale and Halaleddin, the fig is a very healthful and easily digested food, which is much prized by the Orientals as a remedy in kidney and bladder troubles, gallstones, hemorrhoids, and gout.[1] Among the dried figs those imported from Smyrna are most easily digested, and they also have the best taste. Dates are even sweeter, but they are more difficult to digest. They are frequently as sweet as honey; according to my experience, I consider the fresh ones which come from Tunis the easiest to digest. When they are dried they are very hard and must be especially well masticated. According to Balland, the Algerian dates have the following constituents:—

Protein. Per cent.	Fat. Per cent.	Sugar. Per cent.	Other carbohydrates. Per cent.	Cellulose. Per cent.	Salts. Per cent.
1.16	0.06	51.30	15.80	5.06	1.32

Dates contain almost twice as much phosphoric acid as do figs. In the fresh substance they contain 0.12 per cent. of

[1] "The Quuran, Commentaries on the Quuran," by the Rev. E. Wherry, London, 1896, p. 257.

phosphorus and 0.29 per cent. of phosphoric acid, while figs have 0.07 per cent. phosphorus and 0.17 per cent. of phosphoric acid. I find that when dates are not old they are not particularly difficult to digest, and they should be more used.

Dried grapes, which come to us as raisins from Greece or Smyrna, contain a very large amount of sugar; they are principally used in cooking as additions to other foods, such as rice, pastry, etc. Even when in the dried state they are, according to my experience, a useful article of diet; I have frequently eaten, after a vegetarian meal, as much as ¼ kilo, naturally without the seeds. When the seeds are removed—in Greece and in the Orient—the process of removal does not seem to be carried on with any great degree of cleanliness; it is consequently advisable to clean the raisins well before using them. The Malaga grapes, which also come to us in the dried state, are somewhat more difficult to digest, and they always contain the seeds.

According to Balland, raisins contain 0.41 per cent. of protein, 0.56 per cent. fat, and the very large amount of 74.60 per cent. of sugar, together with 2 per cent. of other carbohydrates and less than 2 per cent. of cellulose. Raisins are probably the most useful of the varieties mentioned above, since they contain much more sugar, and are not indigestible for a healthy stomach; when cooked they can also be digested by delicate stomachs. They may consequently be recommended in a strictly vegetarian diet, and each meal, especially of the fruit- and nut- eating vegetarians, should end with a generous supply of raisins. In ¼ kilo about 750 calories are furnished; and when in addition dried bananas, English walnuts, and pistachio nuts are used, a very nourishing meal will have been taken. Nuts containing quite appreciable quantities of albumin, such as groundnuts and almonds, are valuable adjuncts to the daily ration of a fruit-eating vegetarian.

10. *The Special Advantages of Bananas.*

There is probably no more nourishing fruit, or one whose cultivation would be more valuable for mankind, than the banana; it has been stated that the fortunate individuals who have planted them in San Salvador, Brazil, and Java obtain returns 43 times greater from them than from potatoes. This wonderful plant has a remarkable resisting power against injury of any kind, and is seldom affected in any way. In addition to these advantages bananas possess others even more interesting for us—their nourishing qualities and easy digestion. In the fresh state the banana contains from 16 to 22 per cent. of carbohydrates, thus even more than the potato; when dried in the sun they contain, according to Balland (referring to Tahiti bananas), about 70 per cent. of sugar and some varieties from Surinam even more. As far as their digestibility is concerned, I have personally observed that when eating a perfectly ripe banana it will almost melt in the mouth, when simply turned around several times, without any actual mastication, and only the few stringy fibers in the middle of the fruit will remain. In this way 2 or 3 large bananas may be eaten without there being any feeling of discomfort in the stomach. I once saw a young American lady from the West who could eat 26 bananas one after the other without experiencing any discomfort. Of course, bananas are only thus digestible when quite ripe; those still somewhat green are less so, especially when they feel hard on the outside, although when very well masticated they are easily dissolved. When they are quite yellow and already have a few black spots on the outside they can be best digested; they are then softer and also sweeter. The sweetest and best-tasting bananas come from the Canary Islands; next come the red bananas of the West African coast, and then those from Surinam and the West Indies, and the Congo and Brazilian varieties. In Java there are also some

sweet "pisangs," as the bananas are there called, but they are not much exported into Holland. The cold-storage rooms which are to be placed in the vessels of the Nederland Steamship Company may perhaps bring about a great change in this respect. Bananas are not only nutritious owing to their carbohydrate content, but also because of the albumin they contain; in the fresh fruit there is very little, but when dried there is more. In the tables submitted below, the one by Schall and Heisler gives the nutrient contents of the fresh bananas, while Balland gives those of the dried fruit:—

	Albumin. Per cent.	Fat. Per cent.	Carbohydrate. Per cent.	Water. Per cent.	Cellulose. Per cent.	Calories in 100 grams. Per cent.
Fresh bananas	1.00	1.10	18.20	74.90	....	79.00
Dried bananas	4.57	0.45	64.48	20.10	2.80	

According to König, the fresh and dried bananas contain the following constituents:—

	Protein. Per cent.	Fat. Per cent.	Carbohydrate. Per cent.	Invert-sugar. Per cent.	Cellulose. Per cent.
Fresh bananas	1.40	0.47	21.57	....	0.60
Dried bananas	5.25	2.25	52.40	29.12	2.07

The sugar content of fresh fruit is greater when it is fully ripe. The nutritive value of this fruit is shown in a table by Schall and Heisler, which gives the following quantities of nutrient substances in a banana weighing with the skin 100 grams and 70 grams without: Albumin, 0.68 gram; fat, 0.1 gram; carbohydrates, 12.4 grams, making, in all, 55 calories.

In 6 bananas, a number which I frequently ate after a meal, 330 calories are furnished.

The dried banana is especially nutritious, representing about 3000 calories per kilo. I myself found—as I frequently ate those sent from Herrenhut, in Saxony, and also the dried Surinam variety so popular in Holland—that they were so sweet as to make my teeth fairly ache. I could eat five or six of these dried ones without experiencing any difficulty. After they have been left soaking in water for about half an hour they are still very sweet; so the sugar content seems to be natural in the fruit. Undoubtedly these dried bananas are a very nutritious food, which is also easily digested when not too much is taken at one time. The fresh banana could really fill about the same place in a purely vegetable diet as does the potato in a mixed diet, and all the more so since the carbohydrate content is about the same. Bananas, however, have the great advantage that their use does not involve an increase of salt in the body. To be sure, when one wishes to have the sweetest kinds at the lowest price, it will be necessary to travel to London. There one may buy two very large, sweet ones for 4 cents or even less; they are, however, diminishing in price in this country (Austria), as the demand for them is growing greater.

Bananas may be prepared in various ways; they can be fried and baked, and those not yet quite ripe are in this way rendered more digestible. Cut in slices they may be baked in pastry and also be used in omelets. Bananas are likewise very useful in the form of flour; this is also easily digested, although it is made from the unripe fruit. This flour contains as much as 80 per cent. of carbohydrate. When a very ripe banana is laid upon a hot stove in the skin it develops a wonderful aroma, and the fruit becomes partially dissolved. Such a remarkably useful fruit is surely deserving of greater attention in Europe. It is often used for medicinal purposes; in the French colonies

in Cochin China it is prepared in the form of a purée, to be used in cases of severe and prolonged diarrhea. It has the same effect on the intestine as any very sweet vegetable food, namely, it reduces decomposition through a lactic acid fermentation. This action was observed by Collin in 20 cases, in which, instead of giving milk, which cannot readily be obtained in that country, he used a banana diet. It is thus endowed with a remedial action which is not only beneficial in intestinal affections, but in a healthy person as well.

In much the same way as a rice diet and the use of much sugar in general, banana has an antiseptic action upon the decomposition products in the intestine, and may also prevent their development. But simply on account of its digestibility and great nutritive value the banana is a very healthful food. It contains also an appreciable quantity of phosphorus—0.11 per cent. in the fresh substance, with 0.27 per cent. of phosphoric acid.

11. *Oranges, Lemons, and Grapefruit.*

As a refreshing fruit which is at our disposal throughout the greater part of the year, none is more useful than the orange. Both the fruit and the skin can be made use of. The pulp is much developed in some varieties, especially in Messina and Jaffa oranges, but particularly so in the California navel oranges, which are rarely seen in this country (Austria); they have a very sweet, rich pulp, but the Sicilian and Palestine oranges are more juicy. I found the Florida oranges very sweet, but the pulp is not so fully developed as in the California varieties. During my stay in these warm climates and in Mexico, I was in the habit of taking every morning—on an empty stomach—several of the wonderfully fine oranges to be had there; they agreed with me very well. When one should eat oranges can be best learned from the Brazilian proverb:

A Naranja e oura na manhaá, no meiodia prata e na noite mata. (The orange is golden at breakfast, silver at dinner, and deadly at night.) It is a general custom in America to eat 1 or 2 oranges at the beginning of breakfast; the grapefruit is even more used. This is a glorious fruit, two or three times as large as the orange, and when not fully ripe is rather acid and bitter, but when ripe it is quite sweet, with an agreeable, slightly bitter flavor. This fruit may be bought in Vienna and in the seaport cities in Germany, *e.g.*, Hamburg, but can also be found in Berlin and other large cities. It is especially characterized by a great abundance of juice. It is best eaten when halved—in the skin—the central portion containing the seeds is then cut out and the juice flows into the cavity thus formed. A circular cut separates the pulp from the skin, and a series of cuts are then made toward the periphery, which loosens it from the dividing skin. The juice is eaten with a spoon. This is certainly a very delicious and healthful food, especially in hot climates or on a summer morning before breakfast. It has a very pleasant effect upon a dry throat, and is said to be efficacious in fever in hot climates. Owing to its content of citric acid salts and of acids, it has a beneficial action upon the bowels, especially when eaten in the morning upon an empty stomach. It has the same general effect upon the health and certain disease conditions as the acid and nutrient salt-containing fruits, just as has the orange. The juice of the orange contains, according to König, 3.9 per cent. of invert-sugar, 1.93 per cent. of free citric and malic acid, together with 1.39 per cent. of potassium citrate and 0.25 per cent. of calcium citrate.

In regard to medicinal properties the lemon surpasses the two fruits above mentioned. When used as lemonade made with water containing carbonic acid gas, it is very refreshing and may be efficacious in gastric disturbances. The juice is beneficial for the prevention and cure of tonsillitis. It is also

much used in gout; for this purpose several lemons should be taken daily. In several instances which have come under my notice, lemon juice seemed to have a favorable effect in tonsillitis. Oranges and grapefruit are especially useful in diabetes because of the very small quantity of sugar which they contain. I usually allow my diabetic patients to eat one or two oranges every day.

According to Darwin and Buffon, monkeys are in the habit of eating lemons when not feeling quite well. Darwin observed several monkeys which had been made drunk on alcohol the previous day. Of all the foods placed before them they ate only the lemons.

12. *Concerning Certain Varieties of Fruits Little Used except in their Native Countries (Pineapple, Kaki, Chinese Lichées, Mangoes, and Guavas).*

The pineapple is probably not exceeded by any other fruit in regard to perfume and aromatic fragrance. The juice fairly pours out of the fruit even when it is not quite ripe, but in that case it is rather acrid in taste. In this condition it is not so easily digested as when quite ripe; the core is very tough and only the portion between it and the skin should be eaten. Balland states that fresh pineapples contain 12 per cent. of sugar and about 87 per cent. of water; the canned fruit contains 18.40 per cent. of sugar, with 4 per cent. of other carbohydrates, and only 0.57 per cent. of raw fiber. Pineapples are a very refreshing fruit: scarcely exceeded by any other in that respect. Unfortunately they are expensive in this country (Austria), although in Berlin at the large fruit dealers' one can get some at 80 pfennigs (20 cents) a pound, and 1 mark (25 cents) for a better grade of fruit. I found them cheapest in Florida, where I could buy a whole one for 10 cents; while there I ate a medium-sized pineapple every day. In this

country (Austria) pineapples are grown in greenhouses, but they do not have the sweet taste nor the aroma of the native fruit. I consider the pineapple the most effective fruit in constipation.

Still more rare with us is the kaki, a fruit indigenous in Japan, and which is cultivated in southern Tyrol, Italy, and the south of France. When thoroughly ripe it is full of juice, which fairly pours out of it. It is a very easily digested fruit, because the pulp is very soft, almost of the consistency of a purée. I was able to eat 5 or 6 large ones without any inconvenience. It contains a certain quantity of tannic acid, but the taste is in no way affected by it; it also acts well upon the bowels, notwithstanding the acid content. According to König,[1] it contains 66 per cent. water, 0.83 per cent. protein, 0.70 per cent. fat, 14.57 per cent. sugar, and 11.14 per cent. of other carbohydrates, together with 1.70 per cent. of cellulose and 80 per cent. of ash. It is consequently very rich in carbohydrates.

The lichée, a fruit which comes from China, is very rarely seen in this country (Austria). It has a very thin, brownish skin, which is easily broken; the pulp of the fruit is brownish red and has a very pleasant taste, somewhat like that of dried figs, very sweet, and with a slightly peppery after-taste. To be well digested it must be thoroughly masticated, but even then fibrous portions will remain in the mouth, which should not be swallowed. Another variety of exotic fruit, much more digestible, is the mango, which is a yellow or brownish, round or somewhat egg-shaped fruit, with an abundance of juice and a very pleasant taste. It comes from Brazil, Java, and Africa. A very pleasant and healthful fruit is the guava, which grows in South America and Java. When stewed or preserved it is very readily digested, and it also assists the action of the bowels, possibly on account of the cane-sugar contained in it.

[1] König: "Chemie der menschlichen Nahrungs- und Genussmittel," Berlin, i, p. 832.

13. *Practical Hints Concerning Fruit and the Advantages of a Fruit Diet.*

It is of prime importance that fruit be allowed to get as ripe as possible, so that much sugar will be formed in it. In no case should unripe fruit be eaten, because it contains more acids and cellulose than the ripe fruit and has a prejudicial effect upon the digestive processes. When fruit is plucked before it is ripe, it may subsequently ripen when kept in storage, but its taste will always remain inferior and it will be more difficult to digest. In gathering fruit it must be handled carefully, for when the skin is damaged a path is opened for the penetration of many minute living organisms and the consequent occurrence of decomposition. Fruit of this kind should not be eaten, and in any case fruit should always, if at all possible, be washed or cleaned, so that the bacteria which are often present in large numbers on fruit that has been standing in the streets, or in the dust and dirt elsewhere, may not be swallowed along with the fruit when it is eaten. Sartori found harmful bacteria upon fruit which had previously been twice washed. Owing to the quantity of acid contained in some fruits it would be well to wash out the mouth after having eaten much of them; some alkaline mouthwash is best used for this purpose, having also a protective action for the teeth. When one is taking acid fruits, foods containing much starch, such as cakes, floury foods, bananas, etc., should not be eaten at the same time, since acids prevent the sweetening action of the saliva upon the starches, and have an unfavorable influence upon their digestion. Bananas belong rather with the dried fruits, such as figs, raisins, etc., than with the berries. The seeds of fruits should never be swallowed. While the tiny seeds of strawberries or figs can hardly be considered injurious, it is quite different with cherry pits or plum stones. Even they might perhaps not bring on appendicitis, but occasionally large

numbers of cherry stones have caused death. I know of the case of a little girl whose young life was cut short in this way. The entire intestine was found choked up with masses of cherry stones.

A plum stone may also sometimes cause great injury. It gives rise to accumulations of calcareous matter around the stone, forming concretions of great hardness which are found at operation and when cut open disclose the fruit stone in the middle. During life these stones give rise to intestinal colic occurring at intervals and causing very severe pain. Such obstructions may remain for a long time, even many years, in certain localities in the intestines—in a sinus or pouch—without being expelled. The use of fruit in the raw state is suitable only for healthy stomachs and intestines; otherwise fruit should first be cooked. With a healthy stomach it is better to eat fruit with the skin, as in this way more salts and ethereal principles are absorbed.

It is very healthful to eat fruit, and in the winter, when it is difficult to obtain any other fresh fruits, apples and oranges will always do good service. Many fruits, such as pineapples, bananas, and peaches, and other fruits that grow in climates like ours, come from countries such as Australia, the Cape Colony, or South America, where there is summer weather while we are enduring the rigors of winter. When using fruits we may always expect a better action of the bowels, for most fruits produce this effect, either through the cellulose contained in them or sometimes because of the small seeds which excite the intestines to action, or possibly owing to the sugar or acids contained in the fruit. The acid content also alkalinizes the blood, since the acid compounds of the salts are converted into carbonates of the alkali metals during the process of combustion.

Gout is thereby favorably influenced, as it is also by the increased activity of the urinary system. The formation of

uric acid concretions in the kidneys and bladder is prevented. Owing to this alkalinizing property of fruit its use is indicated in cases where a diet rich in meat and leguminous vegetables is indulged in and acid urine is formed, as, in fact, whenever acids are formed in the body, particularly in severe cases of diabetes. In such instances the fruit-sugar may also have a beneficial action, as it tends to antagonize the formation of acetone. In light cases of diabetes it should be remembered that almost the half of the sugar content of fruit consists of fruit-sugar, which is often much better assimilated than other kinds of sugar. In my last work on diabetes I particularly advised the use of fruit by diabetics. Owing to the properties mentioned the eating of fruit is also often of great use in arteriosclerosis, as the fruit juices counteract the abnormal viscidity of the blood. We have already referred to the fact that some skin diseases are much improved by the use of certain kinds of fruit.

We consider it advisable for every one to eat some fruit daily. In the spring, when the cherries ripen, they should be eaten every day as long as the season lasts; then there are the various kinds of berries; later, apricots, plums, pears, and peaches, and in the autumn grapes, which can, with a little care, be kept nearly until Christmas time by hanging the bunches up carefully in a storage room. Hothouse grapes may then come into use; they are available until February or even later, and in June there will again be a fresh crop. Apples are to be had pretty much the whole year round, and oranges as well, except in the autumn.

While referring to the numerous and great advantages of fruit as an article of diet, I must not forget to mention its possible disadvantages. Certain stomachs, particularly those inclined to overacidity, cannot tolerate fruit; but in the cooked form almost anyone can take it without any ill effects. Some fruits, *e.g.*, the strawberry, may in certain persons give rise to

skin eruptions. In cases where the urine is alkaline the use of fruit is contraindicated, particularly such varieties as contain much acid; and certain fruits, such as figs, plums, gooseberries, etc., which contain quite an amount of oxalic acid (figs contain, in 100 grams, 0.1 gram of oxalic acid), should not be indulged in by persons having oxaluria. Where there is much flatulence, fresh fruits should not be eaten; stewed fruits, such as plums, etc., would be much better.

In view of the very great influence of fruit upon the health of the population in general, it would be desirable that the duties collected on fruits be abolished. The importation of fruit, which is not increasing in this country (Austria), is so slight that the budget is not materially increased by the duties collected, and the improvement in the health of the people would save the country many large expenditures which far exceed the revenue from the duties imposed on fruits.

(*m*) Beverages.

1. *Coffee.*

When one leads a regular and frugal life, and has besides the quality of being able to govern his temper, he will not find it necessary to resort to artificial stimulants in order to keep himself up to the mark, or as a consolation factor whenever disappointed or depressed. When one has, however, eaten a full meal of meat, etc., and feels tired and sleepy afterward, it is only natural that he should long for some drink such as coffee. This stirs him up and enlivens him, and he feels much better. For this enlivening action of the coffee we must thank an Arabian shepherd who discovered the coffee bush, having noticed that his flocks were always very active and lively after having eaten the beans which he saw on these bushes. He made and drank a decoction from the beans, and himself experienced a sense of exhilaration. As his neighbors reproved

him, saying that he had sinned against the laws of the prophets, and took him before the Kadi, the story came out, and now the Mohammedans consider this beverage as a gift of God, as a reward for their abstinence from alcohol.

In order that the coffee shall possess this stimulating property, together with an excellent taste and fine aroma, which also enhances the taste, it must first be of a good quality and the next great requirement is that it be freshly ground and made just before using. It is also important that only soft—and when possible distilled—water be used for making coffee. It is often well-nigh impossible for those who must take their meals in restaurants to ever be able to drink a really good aromatic cup of coffee, since it is the custom in most coffee-houses—fortunately not often here in Austria-Hungary—to make a supply for the whole day and to then deal out this black soup as it is required. Although it is asserted that coffee is more healthful when chicory is added, it certainly does not at all improve the taste. Unfortunately, just in that country which obtains the very best coffee from its colonies—Holland—a very great quantity of chicory is used. We must, therefore, pardon the Saxons for their extensive use of such coffee. I have, nevertheless, sometimes drunk better coffee in the very heart of Saxony than in some parts of northern Germany. This does not, of course, refer to the Hanseatic cities, which are renowned for their excellent coffee. Concerning the Dutch coffee, the wife of a greatly esteemed clinician told me that, unfortunately, the very finest coffee from the Dutch colonies—that coming from Preangor—is chiefly sent to Austria, and that in Holland itself it is difficult to get any of it. This is unfortunately frequently the case with the native products of a country.

The very excellent quality of coffee drank in Austria is well known in other countries, and our Carlsbad coffee is everywhere praised. The very fine cream and milk which we

drink here may help to make it so, for coffee is always improved when cream is added to it. In Scandinavia, especially in Denmark and Sweden, the coffee is excellent,—no doubt partially because of the very fine cream. A most important point is the fresh roasting and grinding of coffee, and this is carefully carried out in Carlsbad and in Austria-Hungary in general, but not always in Germany. In one of the very best hotels in Carlsbad coffee is prepared as follows: the roasted coffee is first very finely ground, and is then firmly pressed into a coffee machine, then only one large spoonful of water which has just reached the boiling point is poured over it, and the machine is covered so that the aroma cannot escape. As soon as this water has soaked through the coffee, more of the freshly boiling water is poured over it. The water used for this purpose must be freshly boiled and not such as has been standing for hours on the fire. Drinking-water, and not general utility water, should be used for this purpose. The cream, when used hot, must also be freshly brought to the boiling point, and not first boiled and then left to cool, and afterward warmed up again as required; in that case the coffee will have a grayish color, and "fat-eyes" will gather upon its surface. For making good coffee, 2 decigrams of coffee beans and $^1/_6$ liter of water are required. A good mixture is preferable to only one kind of coffee. When the nerves are easily excited 1 decigram of coffee will be sufficient.

The composition of coffee—when roasted—is as follows, according to König:—

Protein. Per cent.	Caffeine. Per cent.	Fat (ether extract). Per cent.	Sugar. Per cent.	Dextrin. Per cent.	Tannic acid. Per cent.	Other carbohydrates. Per cent.	Cellulose. Per cent.
12.64	1.16	13.85	1.31	1.31	4.65	39.88	18.07

The ash contains the following amount of nutrient salts:—

Potash. Per cent.	Lime. Per cent.	Magnesia. Per cent.	Iron. Per cent.	Phosphoric acid. Per cent.	Sulphuric acid. Per cent.	Silicic acid. Per cent.
61.47	6.19	9.69	0.65	13.39	3.80	0.54

The exhilarating action of coffee is due to its caffeine content. It excites the central nervous system, and large quantities will cause sleeplessness; it is consequently not advisable to take coffee at the evening meal, although many persons are able through habit to drink it just before going to bed without being kept awake. Owing to the caffeine coffee prevents fatigue, as has been experimentally shown by Schumburg with both coffee and tea; in muscular exertion it has a refreshing action. I have personally observed that when taking long tramps of 20 to 30 kilometers I did not get at all tired and made the rest of the way quite easy by taking coffee with my midday meal—after having walked 12 kilometers. When the muscles have already become exhausted caffeine does not have much effect, according to Schumburg. It has, likewise, a stimulating action upon the vasomotor system and the heart activity; the pulse is also increased.

Owing to the increased blood-pressure caused by the caffeine, the use of coffee should be forbidden in arteriosclerosis; caffeine-free coffee is very much better, and it is also well tolerated by the stomach. Coffee, owing to its property of stimulating the intellectual activity and of removing fatigue, is often greatly misused by brainworkers. While it does for a time brace one up for working, the work is paid for with interest by the increased wear and tear, so to speak, of important organs of the body. As far as the stomach is concerned, coffee often causes less injury than tea,—which contains more tannin,—especially when there is overacidity of the stomach; it must, however, not be too strong. Generally speaking, coffee is not indicated in affections of the stomach. Coffee acts as an antidote for certain poisons such as opium and alcohol. Binz found that dogs which had been stupefied by alcohol could be waked up by coffee. It also has a favorable action upon metabolism in the sense that by its use the end-product of nitrogen, *e.g.*, urea, is eliminated in larger quantities, as is also

common salt. Coffee has a diuretic effect. On the other hand, it has an unfavorable action in the uric acid diathesis, as caffeine promotes the formation of uric acid to a considerable extent.

Umber and Schittenhelm strictly prohibit the use of coffee in gout. I consider it a mistake, however, to suddenly absolutely forbid coffee or any similar substance which people may have been accustomed to taking all their lives. It is more practical and even more healthful not to forbid them entirely, but to allow very small quantities. When a person has good kidneys the quantity of uric acid furnished by the caffeine can be readily eliminated; it will only be necessary to lessen the quantity of uric acid by making the coffee quite weak.

The drinking of pure black coffee I consider injurious not only for invalids, but for healthy persons as well, especially when they are at all "nervous"; but a little coffee of good quality with a good deal of cream is, I believe, not injurious for the majority of people. For persons who cannot take ordinary coffee that free from caffeine would prove useful. It tastes very good with cream.

2. *Tea.*

When one drinks tea in England it probably tastes better than on the Continent, but I consider it less healthful, if indeed the term healthful may be used in referring to tea. Personally, I am of a different opinion. The English tea tastes very strong; in fact, the English have a preference for strong spices, flavors, and drinks, which however do them no great harm, as they are especially long-lived. In England the Indian or Ceylon teas are mostly used, which are not only stronger, but also contain more tannic acid, than the Chinese tea. Whoever likes a mild, very pleasant tasting tea would do well to drink "tschaj" in Russia, where it is always brewed in the samovar

at every breakfast, dinner, and supper. This tea tastes better and has a finer aroma than the strong tea one gets in England.

The amount of tannic acid contained in tea plays an important part, for it is this substance which in many persons causes acid eructations after drinking tea; this is especially the case when it is taken on an empty stomach. It is best to take tea with bread and ham, as advised by Hutchison. As they are a tea-drinking nation, English investigators, and Roberts in particular, have carefully considered the qualities and disadvantages of tea. He found that, owing to the tannic acid which it contains, tea retarded the digestion of starches—the Chinese tea less so than other varieties. According to König, the tannic acid content and other constituents of black and green teas are as follows:—

	Nitrogen total. Per cent.	Theine. Per cent.	Tannic substances. Per cent.
Green tea	4.78	1.7	16.8
Black tea	4.58	2.3	15.2

We shall also give the substances contained in the ash.

Tea contains the following nutrient salts:—

Potash. Per cent.	Soda. Per cent.	Lime. Per cent.	Magnesia. Per cent.	Iron oxide. Per cent.	Manganese oxide. Per cent.	Phosphoric acid. Per cent.	Chlorine. Per cent.
37.50	8.01	13.71	5.71	4.47	1.05	7.57	1.69

As shown above, tea is particularly rich in iron. It is also evident that a quantity of tannic substance is contained in tea-leaves—more in the green than in the black. It is just this tannic acid content which is so injurious for the stomach. The longer the tea-leaves are drawn, that is to say, the longer it takes to make the tea, the more tannic acid there will be in it. In order to minimize the effect of the tannic acid Roberts recommends that a small quantity of bicarbonate of soda be placed in the teacup. This also remedies the injurious effect of

the tea upon the digestion of the starches. The taste of the tea is not in any way affected. He also states that it is best to take tea after a meal. With an empty stomach both tea and coffee are injurious. When the stomach is sensitive, Roberts advises the use of very little tea, which should at the same time be quite weak. According to a table by Hutchison, tea is more easily digested than coffee. Thus, 220 cubic centimeters of tea remained only one and one-half hours in the stomach; the same quantity of coffee one and three-quarter hours. Cocoa is even more digestible, for it remained in the stomach only one and one-quarter hours. Tea contains a substance identical with caffeine, which is here called theine. This also has an excitant effect upon the nervous system, in many cases even more so than caffeine, especially in regard to preventing sleep. Tea is consequently no better adapted for the use of nervous persons than is coffee; when one cannot well do without it, it would be advisable to weaken it with a great deal of milk, and in this way the tannic acid would be less disturbing for the digestion.

In preparing tea the directions given by Hutchison, which I shall now quote, should be followed: The water, in boiling, must first be in full ebullition, and the teapot should also be heated, as otherwise many volatile substances would not be drawn out from the leaves. The infusion should only last from four to five minutes, for when it is drawn for a longer time too much tannic acid and other bitter substances will go into the tea. The water is here of the same importance as when making coffee. Hutchison says that the Chinese prefer using the water of running streams, then mountain spring water or that of rivers; spring water is least adapted for the purpose. Since the water should take up air, the pitcher or kettle should be held high up when the water is poured over the tea. The water should not be too rapidly boiled. Hard water is bad, and some bicarbonate of soda should be placed in the pot; otherwise, certain important constituents which affect the

taste would be lacking. In regard to the quantity of tea to be used, I give the English rule quoted by Hutchison: "One teaspoonful for each person and one for the pot."

3. *Maté and its Advantages.*

For persons who are too much excited by tea, maté is an excellent drink; it is less exciting to the nervous system, as I have been most strikingly able to convince myself in the case of an hysterical young lady who was my patient last summer. This tea is made from the leaves of a kind of prickly holly (*Ilex paraguayensis*) which grows in Paraguay and even more plentifully in thickets (Hervaes) in southern Brazil. These leaves are chopped into small pieces or are finely ground. According to the recent experiments of French investigators, maté accelerates the circulation of the blood and diminishes fatigue consequent upon muscular exertion, and also prevents the sensation of hunger without, however, in any way affecting the appetite. In Brazil and in many other countries of South America maté is much used for breakfast, especially by persons subject to stomach disturbances or having diabetes. Whether this tea has any curative properties in such affections must still be determined. That it is fitted to take the place of ordinary tea is shown by the fact that it also contains theine; according to an analysis by Fournier, it contains from 5 to 6 grams of alkaloids to the kilo (caffeine, mateine, theine). König[1] gives the contents of maté as follows:—

Nutrient Salts in Mate.

Protein.	Theine.	Tannin.	Medium amount of tannic acid.
11.20 per cent.	0.89 per cent.	6.89 per cent.	4.50 to 9.59 per cent.

We thus see that maté contains only half as much theine as does tea, and can consequently understand that it must be

[1] König: "Chemie der menschlichen Nahrungs- und Genussmittel," ii, p. 1109.

less exciting to the nervous system. Certain important nutrient salts are also contained in maté, as, for instance, iron in quite considerable amounts, although less than in tea; it also contains much more manganese oxide.

We give here the amounts according to König:—

Lime. Per cent.	Magnesia. Per cent.	Iron oxide. Per cent.	Manganese oxide. Per cent.	Phosphoric acid. Per cent.	Sulphuric acid. Per cent.	Chlorine. Per cent.	Silicic acid. Per cent.
11.46	7.18	3.24	5.57	1.65	1.80	3.04	27.27

In 100 grams of maté are dissolved by water:—

Potash. Per cent.	Lime. Per cent.	Magnesia. Per cent.	Iron oxide. Per cent.	Manganese oxide. Per cent.	Phosphoric acid. Per cent.	Sulphuric acid. Per cent.	Chlorine. Per cent.
0.44	0.14	0.46	0.02	0.11	0.07	0.13	0.22

Larger quantities of maté can be taken without producing the nervous symptoms caused by tea. When one considers that sometimes the Gauchos in the Pampas, when they are far away from the corrals and have been in the saddle for twenty-four hours, have only maté to satisfy their hunger and to drive away the desire for sleep which threatens to overpower them, it must be admitted that the action of the maté must be quite a powerful one.

In preparing maté 3 teaspoonfuls of it are put in cold water, which is then allowed to come to the boiling point. As soon as this has been reached it is removed from the fire, and after two or three minutes it is strained. The product obtained is a greenish-yellow liquid, which has a fine aroma. Milk may be added, and in my opinion it tastes much better than without it. Sugar is always added. Through the kindness of a patient of mine, Mr. Antonio dos Santos, from Rio Janeiro, I received a box of maté, which I took every morning for breakfast during quite a long time. It has a very agreeable taste, and when not made too strong is quite easily digested. After large quantities of a strong brew I always had acid eructations, but this is said not to be the case with most persons. My appetite for breakfast seemed to be improved, and fatigue seemed to be

diminished. I found that I was much less excited after having taken large quantities than was the case with tea. I consider that maté may very well take the place of ordinary tea, when the latter is not well tolerated. Whether it really can replace tea is a question of taste, and in this respect the old Spanish saying is true: "De gustos no hay disputa" (the matter of taste does not admit of dispute). If anyone asks me, however, which is most healthful, tea or maté, I would not hesitate to recommend maté.

4. *Cocoa, Chocolate, and their Advantages.*

As the discoverer, Pizzaro, sailed along the Pacific Coast with his soldiers, they saw everywhere, throughout the kingdom of the Incas, blooming cocoa and carefully planted corn plantations. The celebrated American historian, Prescott, relates this in his work, "The Conquest of Peru." He also states, in his book on the conquest of Mexico by Cortes, that Montezuma, that most unfortunate Emperor of Mexico, had at his disposal 50 pots of cocoa daily for his own use, and 2000 pots for his household. The old Mexicans even accepted bags of cocoa for payments due them. We need not be surprised at the value placed upon cocoa, when we consider that it has a very enlivening and refreshing action. It was for this reason that the celebrated Swedish scholar, Linné (Carl Linnæus), the contemporary and friend of Boerhaave, who was enthusiastically fond of cocoa, called it a gift of the gods,—"theobroma." Secondly, notwithstanding its enlivening and stimulating action, cocoa is less injurious to the nervous system, and is more easily digested than coffee and tea. It is a more dietetic drink and is free from the undesirable reflex effects exerted by coffee and tea. This is a property all the more appreciated by Linné, since our worthy colleague suffered from gout, and had two apoplectic attacks before his death. He

had a large medical practice in Stockholm, which, together with his scientific pursuits, kept him very busy. Linné drank a considerable daily dose of cocoa, and that it agreed with him is surprising in view of the fact that he had gout, for cocoa also contains a similar substance to that present in coffee and tea—theobromine—which furthers the formation of uric acid. It must also not be forgotten that cocoa contains more oxalic acid than any other food substance. It is less exciting than tea and coffee, and is also more easily digested than either. We may also mention that cocoa is made—like coffee and tea—by steeping in hot water. It is only in this way that the soluble substances contained in the leaves and beans, which have previously been cleaned, roasted, and finally ground, can be obtained, together with a greater or less amount of their fat content. The amount of nitrogen contained in cocoa is very large. There are also considerable amounts of nutritive substances, as will be seen by the following table by König. In the cocoa free from oil are contained:—

Protein. Per cent.	Theobromine. Per cent.	Fat. Per cent.	Starches. Per cent.	Other carbohydrates. Per cent.	Cellulose. Per cent.
20.43	1.88	28.34	15.60	17.70	5.37

The nutrient salt content is likewise important, for certain of the salts, especially phosphorus, are present in even larger amounts than in cereals. In the fresh substance cocoa contains, according to Balland, between 0.38 per cent. and 0.57 per cent. of phosphorus and 0.89 per cent. to 1.30 per cent. of phosphoric acid, while coffee only contains 0.13 per cent. to 0.17 per cent. of phosphorus. The composition of the ash, according to König's table, is as follows:—

Nutrient Salts in Cocoa.

Potash. Per cent.	Soda. Per cent.	Lime. Per cent.	Magnesia. Per cent.	Iron oxide. Per cent.	Phosphoric acid. Per cent.	Sulphuric acid. Per cent.	Chlorine. Per cent.
31.43	1.33	5.07	16.26	0.14	30.46	3.74	0.75

The large amount of phosphoric acid and of other nutritive salts present may be noticed in this table.

The very useful cocoa-beans come mostly from South and Central America. They constitute the fruit of the cocoa tree, and may be gathered at almost any time of the year; the tree is constantly bearing fruit, and has the very great advantage over the coffee and tea plants of being very easily cultivated and requiring little care, though exceedingly fruitful. The fruits of the trees in Surinam contain the greatest number of beans, and the finest cocoa comes from Caracas in Venezuela, although that coming from Surinam is but little inferior to it. The greatest quantities are, however, exported from Brazil, from the province of Bahia. I tasted the raw cocoa-beans and found the taste quite pleasant. The greater portion could be readily masticated and was not hard to digest; of course, I only swallowed the part which could be easily chewed. Moreover, cocoa, as I have already stated, is quite well digested, for which reason it is given the preference over coffee and tea in cases of stomach and intestinal catarrh. The Dutch cocoa is very easily digested; in this the cocoa is mixed with potassium carbonate or sodium carbonate, thus making the nutritive substances more soluble. When too much alkali is contained in it, stomach disturbances and diarrhea are easily caused. When it contains much fat the cocoa is not so easily digested, but even then the stomach is less injuriously affected than it is by strong tea or coffee. All in all, cocoa is the most healthful drink among these beverages, with perhaps the exception of maté. It has the advantage not possessed by the three beverages discussed above that, while not exciting, it is enlivening and refreshing and also nourishing. When a person takes 2 or 3 cups of cocoa he is never as much excited as after having drank 2 or 3 cups of tea or coffee. He has at the same time absorbed considerable nourishment, for 100 grams of cocoa contain about 420 calories. For this reason cocoa is not indicated for

persons who are overstout, or for those who do not wish to get too stout; but for those who wish to have a beverage which will be nourishing and not injurious, as, for instance, in diabetes, unsweetened cocoa taken with a very little fruit-sugar would be useful. For vegetarians cocoa is an ideal beverage, as it is also nourishing, which is a feature not to be despised with a vegetable diet. Cocoa mixed with malt, as in malt cocoa, or in the form of chocolate is even more nourishing,[1] as much sugar is contained in chocolate. The rule is that there should be equal parts of cocoa and sugar, but unfortunately there is frequently more sugar and but little cocoa. Chocolate which is properly made with a sufficient quantity of cocoa is not only nourishing, but tastes very good, as in the bonbons "Gianduia di Torino." All properly made varieties of chocolate may be very useful to us, as with a very small amount in bulk a quantity of valuable nutritious substances are absorbed. Owing to its high carbohydrate content chocolate is a particularly well adapted food for those undergoing muscular exertions, as in mountain climbing, etc. Just as when a horse is given a piece of sugar after any special exertion, so when taking very long tramps, or when ascending mountains, we should always take several small pieces of chocolate whenever we stop for a rest. In chocolate, according to König, are contained 6.27 per cent. of protein, 0.62 per cent. of theobromine, 21.20 per cent. of fat, 1.36 per cent. of tartaric acid, 53.70 per cent. of sugar, 4.07 per cent. of starch, with 5.59 per cent. of other carbohydrates and 1.67 per cent. of cellulose. With such a high nutritive content, chocolate, taken as an agreeable delicacy after a meal, would likewise complete the measure of the food taken, especially in the case of strict vegetarians; it is consequently a beneficial habit to have a piece of chocolate in one's pocket to be eaten just after a meal. Chocolate and small

[1] The word chocolate is from the Aztec: Chocolatl; cocoa is from cacahuaquite.

candies should never be taken before meals, as is so frequently done by children and many ladies. From the standpoint of a rational mode of feeding there is no more mistaken and deplorable habit than this childish custom, which spoils the appetite for the principal meals and at the same time undermines the health. After meals it is quite an advisable thing to eat a little candy or chocolate if one wishes to grow fat, or to complete a rather insufficient meal. Many ladies and some gentlemen prefer to take the latter substance in solution in the form of a cup of chocolate; it was preferred in this way by that great epicure, Brillat-Savarin. His directions for making good chocolate[1] were as follows: About 1½ ounces of chocolate (about 50 grams) is dissolved in water over the fire; when it is warmed through, it should be thoroughly stirred and then be allowed to boil for one-fourth hour, until it thickens a little. It is to be taken warm. The best way to make chocolate is, however, that recommended to Brillat-Savarin by Madame d'Arrestrel, the Superior of the Convent of Belley, one hundred and fifty years ago. The chocolate should, according to her, be made the evening before and be left standing overnight in a porcelain pot. In this way it becomes concentrated, and has "*un velouté qui le rend bien meilleur*" (a velvety smoothness which greatly improves it). The greatest amount of chocolate is probably taken in Spain; everywhere from Barcelona to Cadiz I saw it being drunk in the cafés, and I also found the "enciemada" very good.

Cocoa was brought into Spain by Columbus, and the envoy of that country, at that time so rich and powerful, took it as presents to the other courts of Europe; it thus came into general use. In France it is very much used; it is the pleasant custom in that country to pass around chocolate bonbons after the dinner, which I find is at the same time not at all detrimental to the health. At the end of a meal, on a full stomach,

[1] Brillat-Savarin: *Loc. cit.*, p. 20.

is the best time to take them; they do not then interfere with the digestion. Notwithstanding all the praise which has been accorded to chocolate and cocoa, we must not forget to mention that they are injurious in the presence of an oxalic acid diathesis, as they contain as much as 0.45 per cent. of oxalic acid.

5. *Alcoholic Beverages.*

It would hardly fall within the scope of a work on the rational modes of feeding and nourishment to enter fully into a discussion of alcoholic drinks. We have deemed it preferable to give more attention to vegetables and fruits. If we do here refer briefly to alcoholic drinks, it is merely because there are many people who do not consider it an irrational proceeding to indulge in a glass of beer or wine after the day's work, or to add zest to their meal, or, again, simply because they enjoy it. Even if many do take pleasure in a good glass of wine or beer, I do not see why such a custom should be condemned, since we are not really born into this vale of tears to be martyrs. From the standpoint of hygiene, it cannot be affirmed that the taking of a glass of beer or wine, or possibly even two or three glasses of beer and a couple of small glasses of some light wine each day, will cause any great damage. The labors of a number of investigators (Atwater and Benedict, Rosemann, and others) have shown that alcohol has certain nourishing properties. It is also stimulating, and there are many persons who in the intervals of their arduous labors are spurred on to a continuation of their work by a glass of beer or wine. Alcohol is only injurious, for the majority of persons, when taken in large quantities; we have treated this subject in detail in our book, "Old Age Deferred." To forbid the enjoyment of a glass of beer to a hard-working and temperate person because there are others who cannot drink without becoming

intoxicated appears to me to be unjust, and is at all events an interference with personal liberty. Such absolute prohibition, in general, only leads to unbridled indulgence; I noticed, in the case of patients who may have been in the habit of taking 10 to 12 glasses of beer, that, when I allowed them to take one glass of Pilsner beer, which is principally used here, at each meal, they adhered strictly to this amount, but when it was absolutely forbidden they usually drank more. In the case of beer it should be remembered that it is not only an agreeable drink, but is also somewhat nourishing. In addition to its alcohol content—which is happily not at all large—beer also contains sugar and dextrin; in the dark beers there is quite an appreciable quantity. The least injurious beer, from the hygienic standpoint, is that which does not contain much alcohol. The beer which is drunk in this country (Austria) contains only from 3 to 4 per cent. of alcohol; in export beers more alcohol is added to make them keep better; they are consequently rather more injurious. Nevertheless, the beer exported from Austria and Germany does not contain over 6 per cent. of alcohol.

This added amount of alcohol affects the taste of beer, and in Bavaria the beer tastes very much better than it does in distant places in Germany. Since English beers and porter, ale, and stout contain as much as 8 per cent. of alcohol, an Austrian white wine or a Rhine wine is undoubtedly a more healthful drink. Among the beers which contain the smallest amount of alcohol are lager beer and certain varieties drunk in Belgium, such as faro and brun. It is no doubt not an unwarranted assertion to say that a small quantity of beer taken daily will not harm anyone, but that, on the contrary, it may even prove beneficial. It increases the appetite, for instance, and favors the action of the bowels. In many persons a little beer helps the appetite and has an enlivening effect; with others, such as nervous people, it causes them to sleep better.

It is certain, however, that beer is injurious when taken in large quantities not only because of its alcohol content, but also because of the mechanical influence of large quantities of fluid upon the heart, blood-vessels, and kidneys. Such excessive beer drinking may give rise to very serious results, and it is certain that the development of arteriosclerosis may be caused by it. Excessive and sometimes even moderate beer drinking is detrimental in gout, since, according to Haig and Walker Hall, beer—particularly the dark varieties—contains substances which promote the formation of uric acid. In cases of gravel and stone in the bladder it is likewise injurious. Dark beer, in particular, is harmful in diabetes; in fact, it is better for these patients not to take any beer, and the same is true in the case of obesity.

Wine is even less than beer to be considered a nourishing substance; it is strictly as an enjoyable drink that wine is taken. As with beer, it can be stated that a small quantity—say, one or two small glasses of a slightly acid Austrian or Rhine or Mosel wine, and possibly on holidays even an additional glass —taken with the midday meal is not likely to prove injurious; the wine taken should not contain more than 8 per cent. of alcohol. The same quantity of a genuine Hungarian wine, such as the Ofner and Erlauer varieties, or of the French Bordeaux or Austrian Tyrolese wines may be taken, when they do not contain more than 8 per cent. of alcohol. The Pfalz and certain varieties of Mosel wines, which contain 11 to 12 per cent. of alcohol, are more dangerous, as is also Burgundy; a variety of the latter, and also an excellent Bordeaux wine, are made in Belgium.

In the matter of wine the two constituent nations of Belgium are also divided. The Flemish have carried on the worship of Bordeaux wine from the time of their ancestors; they keep it for years in their cellars; and although, according to historical traditions, many illustrious princes of Burgundy

having resided in Bruges, it would seem that Burgundy should be preferred by the Flemish, it is really the Walloons, in the neighborhood of Charleroi and Mons, who are able to age the Burgundy wine as it is done nowhere else; so that even the French travel across the frontier to drink a good Burgundy—in Belgium. Such a Burgundy, however, which tickles the palate with its delicious aroma, is not good for the health, and when a man is gouty and has the means permitting of a choice between Bordeaux and Burgundy, but has not the will power to deprive himself of both—which would be the proper thing to do—Bordeaux is the one to be selected. I forbid both when I am treating gouty patients. In fact, no wine is indicated in gout except perhaps a very moderate amount of a light white wine, although some authors do not positively object to red wine. Wine should also be avoided in arteriosclerosis, as well as in renal and vesical calculi, and especially in cirrhosis of the liver; in fact, alcohol should be avoided in all diseases of the liver. In the majority of nervous diseases wine is not advisable, even when taken in moderate quantities. We cannot deny, however, that good, genuine wine of the lighter varieties has its advantages when used in small quantities. In many persons it has an enlivening and cheering effect, the appetite is stimulated, and in some the desire to work is increased. In diarrhea the tannin content may have a favorable effect, and Neubauer and others have obtained good results in severe cases of diabetes.

I find less excuse for the use of fruit wines when they, like those made from berries, contain 10 to 11 per cent. of alcohol, since in their manufacture sugar is also added, which, by its fermentation, further increases the alcohol content. When one cannot do without taking alcohol in the form of wine, such artificial products should at least not be used; they are more injurious than ordinary light wines. I must also decry these chemical products because of their treacherous and

deceiving effects; a person taking strawberry wine will be more easily intoxicated than with the fermented juice of the vine, *i.e.*, regular wine. Among the substitutes apple wine might be best recommended, since it probably does not contain more alcohol than beer,—about 4½ to 5 per cent. Fruit wines were probably not meant in the verse of the Holy Scriptures in which it says that "Wine maketh glad the heart of man."

When the alcohol content, as in southern wines such as Malaga, and even more so in port-wine (16 to 17 per cent.), is pretty high,—the Tokay wine contains 11 to 12 per cent.,—the dangers of wine may be even greater. Fortunately, the rather high price of these wines prevents their being used to any great extent. As far as their value is concerned, they are rather to be regarded as remedial agents than for simple enjoyment. Taken in small quantities they have a tonic action. A small glass of Tokay, Malaga, or Madeira may be useful for weak or delicate persons, those debilitated by disease, anemic persons, or convalescents after exhausting diseases. In this respect the much more alcoholic cognacs and whisky (40 to 50 per cent. alcohol) are also beneficial. Their only rôle is as remedial agents, and they should be considered as tonics. Other poisonous substances besides alcohol act as remedies in small doses, but when more of them are taken, become poisons. To be sure, there are persons—especially in England and America—who have grown very old while taking such poisons; in my work on "Old Age Deferred" I cited the case of an old lady who, having taken a tablespoonful of whisky every day, lived to be over 100 years old. It is certain, however, that such cases are exceptions, since the devotees of alcohol, especially in the form of alcoholic drinks, go to pieces both bodily and mentally at an early age. We have shown in the above-mentioned work the terrible results due to the use of this scourge of mankind. We shall now close this chapter, as

the limited space available in this work must be devoted to more useful subjects than that of alcoholic beverages.

(*n*) Sugar, Saccharin, Ice-cream, Honey, and Maple Syrup.

A food substance for which children and young girls have a marked predilection is sugar and sweets in general. I am inclined to consider such a craving as a kind of instinct which should not be denied, as it is the expression of some necessity and will have a beneficial effect. It seems to be so in this case, and the satisfying of this craving would appear to be a physiological requirement when we consider that in childhood another of the main food groups—a meat diet—is not indicated, since those of the ductless glands which have the property of destroying the toxic products formed in the organism by the decomposition of the meat in the body are not developed until just before the age of puberty, *e.g.*, the thyroid gland. Siegmund has called attention to the interesting fact that the children who show symptoms of inherited weakness of the thyroid gland have a very decided craving for large quantities of sugar. When such a child was treated with thyroid extract tablets, this desire for sugar decreased. As a counterpart to this fact I would like to cite an observation which I have made upon myself. Every time I have experimentally taken thyroid tablets—2 daily—I found that on taking honey—50 to 60 grams at a time—I felt a decided discomfort and about an hour later great fatigue, which symptoms did not occur when I had not been taking the thyroid extract for several days. It is an interesting fact that when a person has become a pronounced meat-eater he has very little desire for sugar and bonbons, while with children and weak and invalid women who do not care for meat the opposite is the case.

Sugar is the best and the easiest form in which to use carbohydrates as food, since the process of converting other carbohydrates—starch, for instance—is thereby spared, the sugar itself being then used. The sugar we use is either cane- or beet-sugar. As a matter of fact, we use chiefly the latter, as we do not often get cane-sugar. All of the sugar we add to our food is probably cleansed and refined beet-sugar; but both are equally nourishing, though the taste is not the same. While tasting various kinds of beet- and cane- sugar in the harbor of Antwerp, I found that the cane-sugar has a much finer and more agreeable taste, while the beet-sugar has a slight after-taste of the beet. Stewed fruit and marmalades prepared with cane-sugar I found much the best.

If we estimate the value of a food from the standpoint of its taste, then cane-sugar should be given the preference, but otherwise the two varieties are alike, for the sugar of the beet is quite like that of the cane, even though the former does have a slight after-taste. In the form of cut sugar—as the beet-sugar comes to our table—the difference in taste is scarcely distinguishable. Cane-sugar can be eaten from the cane. While in Mexico I saw such pieces of cane for sale in the markets of all of the cities. They form a good-tasting and healthful food. By simply biting the cane, the juice flows out. It is a great pity that we never have it in this country.

Crushed or powdered sugar not only serves for sweetening many of our otherwise rather tasteless foods, such as flour foods, rice, certain sour vegetables, etc., but in certain quantities it also enhances the nutritive value. When not taken in too considerable amounts, sugar is a healthful food, even in solutions; when the latter are very concentrated they may have an irritating effect upon the gastric mucous membrane. Taken in large quantities at one time, as in bonbons, sugar is not a healthful food. It may give rise to fermentation and the formation of acid, and fruit marmalades containing a great

deal of sugar often lie very heavily upon the stomach. Sweets are to be strictly forbidden in obesity, and naturally also in diabetes. In such cases saccharin may be used; but otherwise the use of the latter is not to be recommended; it is certainly dishonest for dealers to use saccharin for sweetening syrups, candies, etc., instead of sugar. This is a fraud, as it has absolutely no nutritive value. Saccharin is otherwise not injurious for the health, as has been proven by a number of experiments, but I am not a partisan of this artificial product, and for many of my diabetic patients, when they do not wish to be entirely deprived of a sweetening substance, I prefer to recommend the taking of very small quantities of fruit-sugar in their coffee, etc. The taste of saccharin is not very agreeable; in some kinds—dulcin, for example—the taste is somewhat alkaline, and in saxin rather less so.

In other countries, especially in America and in England, sweets such as cream bonbons and candies of all sorts are used in enormous quantities, as is well shown by the very great number of shops in which candies and sweets are sold. In the United States and in Canada in all these shops, as well as in most drug stores, ice-cream taken in glasses with soda is sold. I found this variety of ice-cream very pleasant in taste, and it is to be regretted that this "ice-cream soda" has not been introduced here. In some few establishments in Berlin it is to be had. Ice-cream made from fruit juices, with the addition of a great deal of sugar and cream, I do not consider injurious. It has the same effect as sugar in general, viz., the transmission of the energy produced by the carbohydrates to the muscles, which has already been discussed in a special chapter of this work. Notwithstanding its being so cold, it really does not have an unfavorable action upon the stomach, not any more so than a glass of ice-water, which has been the subject of experiments by Best and Cohnheim. The case is quite different when falsified fruit juices and particularly when a poor quality of

cream are used, as is not infrequently the case in vanilla and other ice-creams. This may give rise to very serious consequences through poisoning.

We consider honey as a very excellent and hygienic food. It is gathered as nectar from the flowers by the bees, and is by them digested, thus converting the sugar into invert-sugar—a mixture of grape- and fruit- sugar. The bees then deposit the honey in the combs in the hives. Honey not only contains a very pleasant and palatable substance having the same nutritive value as the carbohydrates, but it also contains small amounts of lecithin and an antiseptic substance, formic acid, furnished by the bee for the preservation of the honey. It contains 78 to 80 per cent. of carbohydrates, including approximately equal parts of grape-sugar and fruit-sugar, although the former somewhat exceeds the amount of the latter. Honey also contains cane-sugar, dextrin, fats, and formic acid. According to its origin, we have the linden, locust, and pine honey. In wooded, mountainous sections we obtain a very highly perfumed honey from the heather and other blossoms, and in some countries, *e.g.*, in Cuba, there is a honey made from the wood narcissi. There is probably scarcely any other article of food which is so greatly falsified as honey, and it would be much the safest plan to buy it in the comb. When buying a clear, fluid honey one is never sure of what one is getting; the colorless white honey is greatly falsified and starch syrup is frequently added to it. Sometimes, although really very rarely, honey may contain poisonous substances which the bees have sipped from poisonous flowers. An account is given in Xenophon's Anabasis of how his entire army fell down in a stupefied condition after having eaten such poisonous honey. Such a result very rarely occurs with the honey which we obtain from the apiarist.

Honey may render us very valuable services. It should never be missing in a vegetarian diet, but in any sort of a diet

good honey taken at breakfast will be very beneficial, as it has a very favorable effect upon the action of the bowels. Owing to its content of formic acid, honey also has certain curative properties, which have, however, been very little considered. In pharyngeal and bronchial catarrh it has a very soothing effect. In some countries it is used as an external application for painful areas. In solution it may be added to certain medicaments and beverages, thus increasing their action. Mead, which is formed by the alcoholic fermentation of honey, is greatly liked in some countries.

(*o*) Injurious and Uninjurious Spices and Condiments.

Even though our foods may contain the most valuable nutritive substances, and may also not be entirely devoid of taste-bearing substances, the latter do not greatly come into play, and, above all, do not exert a stimulating effect upon the appetite, when other substances—spices, aromatics, condiments, etc.—have not been added for the purpose of flavoring them. And since it is so necessary that such substances be mixed with the food, they can surely not all be considered as injurious. Fortunately, our organs, and especially our kidneys, have been so perfectly designed by the Creator that they are able to withstand a temporary extra burden; and although a little pepper or paprika passes through them occasionally, this does not necessarily mean that these organs are consequently doomed to destruction. It is important, however, that this should not occur continuously, and that only small quantities of such substances be used; it is also advisable that only such spices, etc., as are least injurious should be used. Salt is not injurious when not taken in too great quantities; it may even have a beneficial action, as has been stated when referring to the nutrient salts. Many herbs and vegetable condiments, such

as parsley, cives, garlic (in small quantities), capers, marjoram, bayleaves, saffron, etc., are uninjurious. Fruit acids, such as those of the lemon, are not injurious and are often very useful; it is much more healthful to use lemon juice instead of vinegar in making salads. To be sure, a genuine wine or fruit vinegar would not be so bad, were it not so frequently falsified by the addition of sulphuric and hydrochloric acids. The addition of small quantities of wine or fruit vinegars to certain otherwise indigestible foods is not harmful for healthy persons; indeed, it even has the property of softening the hard portions of such foods, thereby making them more digestible.

The condiments which are often added to bread, and particularly the black breads, *i.e.*, caraway, anis, and fennel seeds, probably have no deleterious action; they may, in fact, even exert a beneficial action in stimulating the bowels. The frequent use of strong seasoning, such as onions (the red onions are the best), and still less that of pepper, Spanish pepper (paprika), and ginger, is inadvisable.

It is true that most of us prefer foods which contain a little pepper or paprika, and have a greater appetite for them, and consequently more gastric juice is secreted and they are better digested. Ginger has an even greater action in this respect. Without doubt the appetizing and very palatable properties of many Hungarian dishes are chiefly due to the liberal addition of paprika and red onions, although the special excellence of many products which grow in this so greatly blessed agricultural country may also be an essential factor in the palatability of the food prepared after the Hungarian fashion. It is also certain, however, that these highly seasoned foods which so many Hungarians eat daily have a very deleterious effect upon their health. Many spices and condiments are, on the other hand, not injurious, and are required as additions to food substances. In hot climates, and with us during the heat of summer, the appetite diminishes, and we feel very

little if any hunger. The consequence would be that our nutrition would suffer, were it not for the fact that the all-wise forethought of Nature—which always acts more sensibly than man—has provided in just these hot climates a series of the most powerful herbs and spices. Wherever rice grows—which product is poor in regard to taste-bearing constituents, and where many of the foods rich in starches, but having in general very little taste, also grow—there Mother Nature likewise allows a profusion of spices to thrive. And indeed, as I have already mentioned when speaking of rice foods, the natives, as well as the Europeans living in those countries, use these condiments very freely. They do very little harm, however, in such tropical climates, for the increased activity of the skin helps to carry them off before they have had time to injuriously affect the liver and the kidneys. If these organs are in any way impaired, the consequences will be serious; it is, moreover, a well-known fact that the health of Europeans living in the tropics will become affected if they do not perspire freely. Although these spices are not particularly injurious in such countries, the same is not the case in our latitude. It follows, therefore, *that we should rather use spices, etc., in the hot summertime than in the winter, when it is cold,* especially in the northern winters, where the activity of the skin is suspended and all injurious spices would have to be eliminated by the kidneys, thus subjecting these organs to serious injury.

The taste of many foods, such as rice, coming from exotic countries is, in fact, very materially improved by the addition of saffron, cinnamon, etc. (rice with cinnamon and raisins is a delicious dish), while vanilla gives a fine aroma to sweets and pastry. All of these, when used in small quantities, as is usually the case, are probably not injurious. Pepper is also less injurious when it has been kept in a finely ground condition for some time, by which the greater part of the ethereal oils are volatilized, and is only then used in foods. The grind-

ing of the pepper should, however, be done at home, as when one buys the powdered pepper it is impossible to say, just as is the case with other spices in this form, what may have been added to them.

CHAPTER V.

VEGETARIANISM AND ITS ADVANTAGES AND DISADVANTAGES. HINTS FOR THE PREVENTION OF THE LATTER.

1. *The Dangers of a Strictly Vegetarian Diet.*

It is the object of these lines to prove that a strictly vegetarian diet, when continued for a long time, is a very unhealthful and dangerous mode of nourishment. It is above all most irrational. For when—as I have so frequently seen in the vegetarian restaurants in Germany—a person who works hard all day takes for his midday meal a plate of green-vegetable soup, then, as the principal dish of the repast, carrots or spinach with potatoes, after this some apple sauce, and finally a few nuts or a small quantity of some other fruit, he is in great danger. It is truly a murderous diet. His evening meal is also similarly composed, and his breakfast consists of some substitute for coffee. As a person absorbs with such a diet only a minimum quantity of albumin and carbohydrates, he subjects himself to all the dangers which we have enumerated in the chapters devoted to a one-sided diet and to insufficient nourishment. The greatest of these is, however, the fact that the composition of the principal fluid of the body—the blood—is defective and its quantity is insufficient.

This gives rise to anemia, and a most frequent result of such long-continued undernutrition is tuberculosis. Indeed, notwithstanding frequent visits to vegetarian restaurants in various countries, I have never seen a strict vegetarian who did not look pale and thin.

There cannot possibly be a really scientific basis for such an erroneous mode of living. The most important producer of

energy in our foods, the albumin, is only very slightly represented, and of this limited amount a considerable portion is lost in the intestine owing to the difficult assimilation. Since, however, strict vegetarians do not lay much stress upon albumin, the carbohydrates should necessarily be all the more plentifully represented in their nourishment. It is, nevertheless, unfortunately the case that in the majority of vegetarian restaurants in Austria and particularly in Germany the main object seems to be to furnish very cheap foods. They are consequently greatly frequented by poor people who wish to dine cheaply. The proprietor naturally wishes to realize as much as possible; consequently many aliments containing considerable amounts of carbohydrate, such as tapioca, sago, maizena, honey, and sometimes even rice, do not appear on their bills of fare, or are possibly not much called for, as the price is too high. According to Rubner, when there is too little albumin in the food, more carbohydrates and fats are necessary. In such a ridiculously strict vegetable diet this point is not even considered. The food consists principally of vegetables, and possibly cereals and fruit; in the majority of cases, however, the bulk of the food is composed of green vegetables, roots, cabbages, etc. Considerable amounts of these must then be taken in order to fill the requirements of the moment, and to still hunger.

The cow is in the field from early morning until the evening in order to—and this is her only occupation—absorb a sufficient quantity of food for her needs; and since the latter consists of grass which is not very rich in nitrogen, she must take a very great deal of it to thrive. If she does not do this and stops feeding, she is ill. A cow cannot starve for several days, nor can a strict vegetarian do so. He also must, day in and day out, take large quantities of food; I must admit, however, that some who subsist upon a fruit diet can, after a long training, manage with less. Whether they are as thor-

oughly invulnerable to a possible infection as those who use all kinds of foods is a question. The average strict vegetarian must, therefore, eat large quantities of cabbage and other varieties of vegetables, cereals, potatoes, etc. In order to utilize and assimilate it all, he would have to imitate the cow and possess four stomachs, to rechew his food. The intestine would have to be very much longer, with a large cecal pouch, containing the same ferment as in the rodents,—the cytase,—for him to be able to digest the great quantity of cellulose contained in such food. Since, however, he is not provided with all this, he will fare badly when such a diet is too long continued. To assist, in so far as possible, the digestion and assimilation of the foods in themselves already so poor in albumin, these foods must be very carefully masticated, which is only possible when the teeth are good; much saliva and gastric juice must also be provided—we have already mentioned that bread requires five times as much pepsin as meat—and the intestine must secrete much fluid, in order to further the digestion and the elimination of the large amounts of feces resulting from such foods. All this would require an outlay on the part of the organism, since the cells thus given off would have to be replaced. The only substance in the food capable of accomplishing this renewal is the albumin. Now, in such a strictly vegetarian diet the absorption of albumin is very slight, for the intestinal juice cannot readily digest the cellulose in which the albumin is inclosed. Animals are better off in this respect, for all-wise Nature provides whatever is required to fit the circumstances, and has given to rodents a special ferment which breaks down the cellulose. As the human vegetarian is not provided with such ferment, much of the albumin in his food is lost to him. The starches are for the same reason also poorly assimilated. A considerable portion of the albumin and starch content of the food is also lost because such a diet exerts an irritating effect upon the intes-

tine, and it is consequently expelled too soon, before the nutrient substances have been absorbed. As a result of this, with the usual food of a strict vegetarian there must undoubtedly be a deficiency of albumin, as well as of carbohydrate; such a person is undernourished and is consequently subject to the dangers above named.

A great disadvantage of such an erroneous mode of feeding is the very great amount of feces formed and the too frequent bowel movements. I have myself experimented with such a strict vegetarian diet for several days, and found that, instead of having, as usual, one bowel movement each day, there were two or three and sometimes even more; the feces were very much increased, as a considerable portion of the food itself was expelled with them. Such an augmentation of the stools is in no way advantageous, as the intestine is subjected to too violent exertion. While the cow gives off a quantity of dung, it serves as a valuable fertilizer for the earth from which she receives her nourishment; human excrements play no special rôle in this connection.

It is certain that the digestive organs must suffer under such a diet, and that they must undergo certain changes due to their overactivity; this is self-evident owing to the fact that they were not adapted by nature for such use. When a true vegetarian parent wishes to bring up his child—after it has been weaned—upon a strictly vegetable diet, it may be possible that the child's intestines will become longer and better adapted for such food, but in the adult this is not to be expected. Since, however, the suckling child of the vegetarian lives solely upon milk, *i.e.,* a substance of animal origin, and could not be nourished in any other way, I cannot comprehend why he does not realize that this forms the proper food for the child, and does not therefore continue to feed it upon a milk-egg-vegetable diet, which is in my opinion the best and most rational one.

Such a strictly vegetable diet very frequently gives rise to gastric and intestinal disturbances, and many a vegetarian would undoubtedly be cured of his mania—for they are indeed often fanatics—were he to be shown his feces with the large amounts of undigested food contained therein. The intestines have vainly endeavored to utilize the latter, but the results are not at all in proportion to the effort entailed. Such a defective diet also has an injurious effect upon the nervous system and the mind as well, which fact has previously been referred to. While it is thus injurious to a normal individual, the vegetable diet may, on the other hand, be very beneficial in certain diseases, such as gout, arteriosclerosis, diabetes, and obesity. All of these diseases are frequently the result of overfeeding, and consequently a less generous and nutritious diet, such as the purely vegetarian one, may be most useful. When, however, such a diet is to be persisted in for any length of time without giving rise to injurious consequences, certain rules must be followed which we shall discuss in the next chapter.

2. *Hints in Regard to the Rational Procedure in a Strictly Vegetarian Diet.*

The most important requirement in a rational vegetarian diet is the thorough cooking of the food, by which the cellulose coverings are burst asunder, thus enabling the digestive fluids to act successfully upon their contents. This requires a scientific mode of cooking, and it must be remembered that too great a heat must not be long continued. The starch granules are swollen by the heat, their outer covering is burst open, and the albuminous contents are freed; when, however, the heat is too great, they may, on the other hand, become shriveled up, and in this case the outer covering of cellulose will remain intact. It would therefore be more to the purpose not to subject the foods to a very great heat for any length of time, and

cooking in a steaming apparatus would undoubtedly be the best procedure, since in this way the important nutritive salts are not extracted from the vegetables, which very readily occurs when they are cooked in water for a long time.

Thorough mastication of the food is even more important with a vegetarian than with a meat diet, since the action of the digestive fluids upon the cellulose-rich vegetables is materially lessened when the latter are not well masticated. For the meat-eater it does not so much matter whether a little more or less of his albumin-rich food is lost, while in the vegetarian diet, which is already poor in albumin, this plays an injurious rôle. Only a person having excellent teeth can be a good vegetarian; when the latter are defective, as in the case of old people, the vegetables must be prepared in a fluid form or as purées or soups, or be chopped very fine.

It would be much the best for all vegetarians to take the vegetables containing the greatest amount of albumin in this form, as it is otherwise, *i.e.*, in the leguminous vegetables, only very poorly assimilated, so that much of it is unavoidably lost. Some of the vegetables which are eaten without the shells—peas, for example—are better assimilated, but lentils and beans less so. The latter had much better be taken mashed into a purée. Soy beans are also good when prepared in this way, and would prove a valuable addition to a vegetarian diet. In the vegetarian restaurants which claim to furnish a nourishing menu—not always a very sensible one, as one so often finds—such purées of leguminous vegetables should be a daily item of the bill of fare.

It would, moreover, be advisable that sufficient quantities of albumin-containing foods, such as leguminous vegetables, mushrooms, etc., be regularly included among those constituting a vegetable diet. For old, weak people, or those subject to flatulence, the only resource would be some nutritious preparation made from albumin-containing vegetables—such as

sarton, which is made of soy beans, or roborat, prepared from the albumin of wheat. Small quantities of these substances will furnish as much albumin as is contained in much larger amounts of cereals or bread.

The albumin-containing cereals in general should be very well represented in the strictly vegetarian diet not only on account of the albumin, but because of the high carbohydrate content. In the diet of the unscientific vegetarian—unfortunately such ignorant procedures are the rule—the albumin and carbohydrate content is not considered, and both of these substances are insufficiently represented. Even at best, this is still the case with the albumin; therefore, correspondingly greater amounts of carbohydrates should be absorbed. Cereals can be used to meet these requirements, but not in the form of a coarse, whole-wheat, or graham bread, so often furnished in vegetarian restaurants; fine wheat bread should be used instead. For a meat-eater, or even a person living upon a diet consisting of milk, eggs, and vegetables, the coarser bread would be better adapted, as it contains more of the nutrient salts and also more cellulose. The vegetarian already ingests a plentiful supply of the latter, and what he requires is more of nutritious substances, which will be furnished by the otherwise prohibited fine wheat bread.

Oats would be a practical food for strict vegetarians, but should be used in a form in which the albumin and carbohydrates can be assimilated—especially in the case of old and weak persons—*e.g.*, in the form of one of the prepared oat foods, such as Knorr's preparation or Quaker oats. All other similar carbohydrate-containing foods, such as rice, buckwheat, etc., would also be very beneficial, because the portions which are difficult to digest—the husks—have been removed. They are more readily assimilated in this form, and the nutritive value is also increased. This is, of course, of great importance in a vegetable diet, which is less nutritious than any other.

Tapioca, sago, rice, and similar aliments containing carbohydrates, but poor in cellulose, should always be abundantly represented in any form of vegetable diet.

The dishes prepared from a mixture of fine wheat meal and potato flour, so frequently eaten in Austria-Hungary and used in another form for breakfast in America, are also very advantageous. In the last-named country they consist often of a kind of gruel made of wheat (cream of wheat) or of oats, and also include cakes of wheat, buckwheat, or corn flour which resemble our pancakes. The Americans eat with these a syrup (maple syrup) made in Canada or Vermont from the sap of the maple tree. With us such a breakfast would be especially useful for vegetarians, and in this way one would be sure of having an appreciable quantity of carbohydrate in the food. As the maple syrup is difficult to obtain here, one might use with the cakes a syrup made of cane-sugar, like that which comes from Java (the Gula Java of the Malays), or honey, which is similar to these syrups. Their use has the advantage that the nutritive value is increased by the sugar contained in them. Some fat had best be used with these cakes; and since the strict vegetarian abjures animal fats, the best varieties of vegetable fats—those containing the least of the fatty acids—such as fine olive oil, palm oil, etc., should be used. In fact, a certain amount of fats is quite as necessary in a vegetable diet as the carbohydrates, albumin being so very poorly represented. With green vegetables, including salad (best mixed with vinegar), a good proportion of fat can be absorbed, and fat-containing fruits and nuts—such as the fatty groundnuts (Arachides) which come to us from the Congo, Brazil, etc.—may also be used. Naturally, these must all be very carefully masticated, as they are not very digestible owing to the high fat content.

In the way of fruit the disciples of a strictly vegetable diet should give the preference to the very nourishing dried

fruits,—although they are rather hard to digest on account of the increased proportion of raw fiber. In regard to difficulty of digestion, dried bananas—such as are imported from Surinam by Abraham Dürninger in Herrenhut, and which are much used in Holland—form an exception. I frequently eat them myself in the summer months when I live upon a vegetable diet, and find them easy to digest and very nutritious. As has already been stated, bananas contain but little cellulose; the drying process greatly increases the sugar content, so that, although the starch content of the fresh ripe banana is only 16.20 per cent., dried bananas often contain 70 per cent. of sugar or sometimes even more. Figs and dates, English walnuts, hazelnuts, pistachio nuts, etc., and fresh fruits should always be represented in the dessert taken by vegetarians.

The menu of the strict vegetarian should thus rationally be so combined that at the principal meal, after a vegetable purée soup, some albumin-containing food such as mushrooms or some leguminous vegetable (best in purée form) should be taken, together with green vegetables combined with some vegetable fat; next either tapioca, sago, or rice, etc., then pastry or cakes, and afterward nuts and dried or fresh fruits. As a dessert, in order to increase the nutritive value of the diet, some chocolate might also be taken,—this best in the form of the fat-containing Giandujas of Turin, which readily melt in the mouth, or some other form of cream chocolate. In conformity with the physiology of digestion, sweets, when eaten alone, should always be taken at the end of a meal. After the repast a cup of caffeine-free coffee may be taken. For breakfast the flat cakes or the various gruels made of cereals, with honey and fruit, are indicated as the principal components of the meal, and for the evening repast albumin-containing vegetables, green vegetables, and other starchy foods, together with fruit, should again be taken.

Menus in the vegetarian restaurants should likewise be

made up according to the rules given above. A great drawback in this connection is the fact that motives of economy prevail in these establishments. The main object seems to be the giving of as much as is at all possible for at most 1 mark (25 cents) or for 70 or 80 pfennigs (18 or 20 cents). That food of the very best quality is consequently not the rule is as regrettable as it is easily understood. When the true vegetarian, owing to the inferior quality of the food, thus absorbs even less of nutritious substances than he would otherwise have, he is even more exposed to undernutrition. It would be very advantageous if in all large cities vegetarian societies or clubs were formed which would build and control restaurants of this kind. In Manchester, England, a splendid example of such a society exists, which does very excellent work; it is materially assisted by benefactions from those interested in its success. It is greatly to be regretted that we do not here also have some wealthy vegetarians who would construct such vegetarian restaurants in the interests of the public welfare in general. Establishments of this kind should also be founded by persons dying without heirs, and who wish to perpetuate their names by some benefaction which would help to prolong the life of many. In this way vegetarianism could prolong life, but only when practised upon scientific lines. The greatest prospect of a prolonged existence is, however, only afforded by the milk-egg-vegetable diet, which we shall now discuss. A strictly vegetable diet as above described may be continued for weeks, or perhaps even months, by some persons—and by some women of a certain constitution and build even longer—but the majority of average individuals often suffer from intestinal disturbances and stomach affections—very frequently over-acidity. These results, as well as nervous affections, then render a change of diet imperative.

3. *The Special Advantages of the Milk-Egg-Vegetable Diet.*

It would not be difficult for us to prove that the milk-egg-vegetable diet is the most rational for man, especially for the adult. When near the age of puberty, the addition of a certain quantity of meat would be advisable for reasons which have already been given.

That the milk-egg-vegetable diet is that best adapted for man is shown by the fact that each one of the principal components of which it is made up, *i.e.*, the milk, the eggs, and the vegetables, plays a most useful part in our nutrition. Their useful properties have already been treated at length. The best feature of such a method of feeding is that each of the three foods is possessed of advantages, but of no evil effect. To live upon milk alone would be difficult as well as inadequate, even if very large quantities were taken; the same remark applies to vegetables. When, however, eggs are used in conjunction with milk and vegetables, a very substantial diet is obtained, and as I have noticed in my patients, and likewise with myself, one can gain considerably in weight when living upon such a diet. When 1½ liters of milk are taken per day an average of about 60 grams of albumin is received; 2 eggs added daily to the milk will raise the albumin assimilated to 70 grams; if 4 eggs are taken, one will have obtained a fully sufficient quantity of albumin. I have myself lived upon such a milk-egg-vegetable diet for several months, and got on very well indeed with 70 grams of albumin, although I was taking considerable exercise at the time. I have also observed that a diet of milk and eggs and plenty of carbohydrates has a tendency to accustom one to thrive on a rather smaller amount of albumin.

There is probably no other diet which contains less of substances which are injurious for our various organs. The

milk diet is the least injurious. Both milk and eggs do not form any uric acid, nor do they contain any injurious extractive substances. The same is the case with most of the vegetables, especially those which are richest in starch, such as rice, tapioca, sago, etc. The majority of ripe fruits, with the exception of those containing considerable amounts of oxalic acid, are also free of injurious substances. In order to carry on such a diet in a rational manner, it would be necessary to take, as a basis for it, 4 or 6 eggs daily, with some cheese. At each meal, or at midday and in the evening, 2 eggs should be taken, with milk and cheese, and perhaps for breakfast 1 of the pancakes previously referred to—made of various kinds of flour—with honey or some fruit syrup; fresh fruit at every meal; fresh fruit for breakfast, and both cooked and fresh fruits at dinner and supper. I also consider it very beneficial to eat, during several days, fruit only at the evening meal; this might also be done on certain days of the week instead of on successive days. For such a meal the most nourishing foods would be dried fruits, bananas, St. John's bread (the dried fruit of the locust tree—which must be thoroughly masticated), figs, dates, nuts, with dried currants and raisins (thus mixed they taste very good), almonds, and particularly pistachio nuts, which are the most easily digested of the oily nuts. In winter the fat-containing nuts and fruits are best; on hot summer days principally fresh fruits should be taken—cherries in the spring and early summer, grapes in the autumn, and in midsummer apples, pears, and plums.

I particularly advise the taking of plenty of fruit because, among all our foods, with the exception of milk, this food is the only one which we take just as it was made by the Creator, without any cooking or the addition of other substances. In this way all of the natural properties remain undisturbed. We must here emphasize the fact that many of the important ferments contained in various foods are destroyed in the prepara-

tion of the latter, so that we lose all of their effects. As, however, many of the fresh fruits contain rather too much acid, which has an injurious effect upon some persons, dried fruits or those containing but little acid when fresh, such as bananas, dates, etc., should be taken when considerable quantities are to be eaten. A healthy stomach and intestine is required, and then bread, butter, and cheese, with fresh and dried fruits, will furnish a good and healthful meal.

There is no diet which will as certainly preserve good health or which will so effectively favor a return to health as the milk-egg-vegetable diet, *scientifically employed.* With no other diet can so much be done to keep the blood-vessels in good condition, and to insure a proper composition of the blood and its adequate circulation. Such a diet would be the very best in arteriosclerosis, but here not more than 1 liter of milk divided into several portions must be taken. According to my experience with a large number of patients, there can surely be no better mode of nutrition than the above, and all of my liver patients—without exception—had a better color and looked much more healthy after two or three weeks of such a diet. I wish to call attention to the fact that particularly in cases of gallstones it gave very good results, especially because the functions of the bowels were perfectly carried on. The advantages of this diet in such affections reside in the fact that the lactic acid fermentation (I prefer to give sour milk, jogurt, and kefir in such cases) brings about antisepsis of the intestine and prevents the development of injurious bacteria, so that infection of the gall-duct—the principal factor in inflammation of the gall-duct and the disease above mentioned—is more readily prevented. Plenty of grapes taken with such a diet gave excellent results in gall-stone disease, in my experience. That it is also very beneficial in gout is self-evident, but vegetables containing purin bodies—of which a list is given on page 361—should as far as possible be avoided. Chiefly the

ripe acid fruits should be used. In renal calculi consisting of uric acid a diet of this sort also has an excellent effect; when there are phosphatic stones it should, on the contrary, be avoided. For diabetic patients it is an ideal diet, but a milk without sugar, like the Gaertner preparation, should be used, and the fruit be carefully selected and taken only in moderation. In obesity it is likewise an excellent *régime;* the quantity of milk must however be decidedly diminished, and the butter and oily fruits and nuts must be eliminated. Owing to its favorable action upon injurious bacterial intestinal flora, such a diet would be beneficial in intestinal affections, with a careful selection of the vegetables and fruits to be taken. In constipation it would prove a sovereign remedy which would after a short time render all medicines superfluous. In many cases of neurasthenia and hysteria it would give brilliant results, if the foods giving the greatest number of calories were selected. Since such a number of diseases are benefited by this diet, healthy persons should profit even more from it. Indeed, after having personally tried the various modes of diet during a certain length of time, having first eaten a great deal of meat and then only once a day; again for a time only vegetables, then principally milk, then chiefly fruits, I came to the conclusion—after observations made upon others as well as upon myself—that a milk-egg-vegetable diet is the best and at the same time the most rational for mankind.

CHAPTER VI.

THE PRACTICAL ADVANTAGES OF RATIONAL FEEDING. USEFUL HINTS.

1. *Foods Easy and Difficult to Digest.*

THERE are persons who can, as it were, digest pebbles, while others no less healthy may suffer from indigestion after taking even the most easily digested foods. There is probably no other organ as capricious as the stomach. We shall not attempt here to deal with the nervous influences and idiosyncrasies affecting the stomach, but shall discuss only such disturbances as are caused by the food itself. In order that food may be easily digested, it must be in such a form as will permit of thorough action upon it by the gastric and intestinal juices; thus, a gelatinous substance like a pickled fish jelly is very easily digested. When, however, there is much connective tissue, as in an old chicken, digestion is more difficult; the tough, hard meat of old animals, which has so much connective tissue, is much more difficult of digestion than that of young animals. Lean boiled ham, being so free from connective tissue, is not only easily digested by the stomach, but by the intestine as well; the digestibility of a food depends not only upon the readiness with which it is tolerated by the stomach, but also by the intestine. Hard-boiled eggs are digested with difficulty by some stomachs, and are better assimilated in the intestine. Calves' brains are readily digested in the stomach, but less so in the intestine, since, according to Rubner, about 43 per cent. of such brain substance remains unassimilated.

The connective tissue in meat corresponds with the cellulose in vegetables. A fine starchy food without any such material, *e.g.*, tapioca and sago, does not impose any labor on the stomach when well masticated, as it is not digested there; such a food does remain in the stomach for some time, but is only really made use of when it reaches the intestine. Thorough mastication, as already stated, is a prime necessity with starchy foods. A ripe banana is one of the most easily digested foods, when carefully masticated with the aid of plenty of saliva. It is advisable to allow such starchy foods to remain in the mouth for a short time, during which they should be moved about with the tongue and then be carefully chewed. When hard, dry foods containing much cellulose—such as the cereals, dried tubers, dried pears, or the black bread of the peasants—are taken, they not only remain a long time in the stomach, which must work hard to digest them, but are besides poorly assimilated in the intestine. We have mentioned on several occasions how much of certain foods remains unutilized during intestinal digestion. It is not our purpose to deter healthy persons from taking such foods, for it is, on the contrary, not inadvisable occasionally to eat small quantities of them. Unfortunately, the poor are obliged to eat them daily—without, however, actually ruining their health thereby.

In addition to the connective tissue and cellulose content, fat—especially lamb- and beef- fat—also interferes with digestion, particularly when it surrounds the more easily digested substances. Fat lamb is very indigestible. Dishes prepared with beef-drippings, so much used in England, are likewise not at all easily digested. Goose-fat is that which melts most readily, and butter comes next. Fine olive oil is well adapted for cooking; foods prepared with it are not indigestible. Fatty fruits and those containing cellulose, such as hazelnuts and old walnuts, are hard to digest.

The large amount of free fatty acids and pungent sub-

stances contained in some foods, and the acids, tannin, and ethereal oils of certain fruits, may all interfere with the digestion. Following is the list prepared by Penzoldt showing the digestibility of various foods:—

Foods Remaining in the Stomach About Two Hours:

100 to 200 grams of drinking-water;
220 grams of carbonated water;
200 grams of coffee, tea, beer, bouillon, light wine;
100 to 200 grams of milk;
100 grams of soft-boiled eggs;

About Two to Three Hours:

200 grams of coffee with cream, or milk cocoa;
300 to 500 grams of water, milk, or beer;
100 grams of raw, hard-boiled, or fried eggs;
200 grams of cooked sweetbreads, carp, pike, or cod (including dried cod);
72 grams of cooked oysters;
150 grams of boiled asparagus or potatoes, mashed potatoes, cherries (raw or steamed);
70 grams of white bread or biscuits;

About Three to Four Hours:

230 grams of cooked chicken or partridge;
220 to 260 grams of cooked squab;
195 grams of squab, boiled or steamed;
250 grams of boiled beef;
160 grams of raw or boiled ham;
100 grams of roast veal (hot or cold), beefsteak, roast beef;
200 grams of boiled salmon;
72 grams of salted caviar;
150 grams of black or brown bread, spinach, or kohlrabi, carrots, cucumber salad, apples.

We may select our foods from the above list according to the condition of our stomachs, always giving the preference to those articles most easily digested. For, as was said by a Frenchman: "On ne vit de ce qu'on mange, mais de ce qu'on digère." (One does not live by that which one eats, but by that which one digests.)

2. *Foods Causing Flatulence. The Prevention and Dietetic Treatment of Flatulence.*

By flatulence we mean the formation of gases in the intestine. They are formed by the action of bacteria upon the residue of the food which has been absorbed, and particularly upon the cellulose contained therein; the latter is then split up into volatile fatty acids (butyric acid, acetic acid) and into gases (carbon dioxide, hydrogen, and methane). The more cellulose there is contained in the food, the more there is usually eliminated as residue, thus facilitating the production of such cleavage products. Consequently, a diet rich in cellulose will form much gas. This may be noticed when leguminous vegetables, especially beans, have been eaten; cabbages also produce the same effect, on account of the cellulose and sulphur contained in them. Black bread, *e.g.*, rye bread, also causes considerable flatulence.

On the other hand, a diet which forms but little residue may also produce gases when certain bacteria have been introduced with it. Unclean water, previously in contact with a slimy river-bottom, will often cause discomfort by colic and the formation of gas. I myself noticed this during my stay in Toronto, in Canada; on drinking the water of the large lake, I was constantly troubled with gases and colic. The same was the case soon after, when I was in Detroit and drank the water from Lake Michigan. In both these places I experienced no such trouble when drinking pure mineral water.

Mineral waters which are badly bottled, so that unclean substances are mixed with them, may give rise to the same symptoms. It is necessary, for this reason, to make a careful selection from among such waters. Above all, it is necessary that the authorities should make a thorough investigation of every mineral spring of which the water is universally used, as well as of the bottling plants. Impure milk, made so by

secret dilution or the inadvertent admixture of any unclean substance, will very frequently cause the development of gases. Flatulence may also be noticed when large quantities of good milk are taken.

Flatulence very readily occurs when the residue of the food remains too long in the intestine. The longer the feces are retained in the intestine, the longer the bacteria act upon them, thus causing fermentation and decomposition. The greatest number of bacteria is found in the colon, and the feces contained therein form the most favorable nidus for them.

A plentiful meat diet also favors the formation of gases when the former contains much connective tissue, since, owing to the large quantity of meat and the resistance offered by the connective tissue, the digestive fluids are not able to fully digest it, and a considerable portion remains to be subjected to the action of the bacteria in the colon. The longer it remains there, the more gases may be formed. In order to prevent the formation of gases it is important that the feces be expelled from the intestine as soon as possible. Constipation must therefore be avoided. The means for its avoidance will be considered elsewhere.

Persons having a tendency to flatulence should avoid foods which contain much residual matter, such as beans, lentils, and the cabbage varieties, in which not only the cellulose, but also certain other components, viz., sulphur compounds, cause the formation of gases. In the diet of such persons all indigestible foods should be avoided and care be taken that the diet be so composed that its greater portion be absorbed in the upper intestine, so that a very small quantity will be subjected to the action of the bacteria. Especially in the case of aged persons should a careful choice of foods be made, as in them the intestines are relaxed and dilated, and the residue is apt to be retained in the bowel for a longer time. We are thus, to be sure, placed in a dilemma, as when the food contains too little

refuse matter the residue will for this reason remain too long in the intestine. Such feces, however, are not apt to cause flatulence. We must consequently endeavor to steer between two cliffs.

The foods causing the most flatulence, such as leguminous vegetables, cabbage, black bread, etc., must of course be eliminated from the diet, and when necessary milk must also be forbidden or only allowed in small quantities. Care must also be taken that its origin be irreproachable. A diet easily digested must be adhered to; it may be composed of tender meat, ham, eggs, rice, tapioca, sago, fine white bread, zwieback, etc. Potatoes are only allowed when mashed, as fried or roasted potatoes give rise to flatulency. Bread made with a sour dough should be avoided, as in this way large quantities of bacteria are introduced. Whatever might cause fermentative processes must be usually avoided. Beer especially is forbidden. Tea or even a little red wine might be used to advantage.

In the dietetic treatment of flatulence a principal factor is the avoidance of foods containing much residue. Although such a diet is useful in persons subject to this disturbance, it is not indicated for those in good health, as it may give rise to constipation. The formation of a small amount of gas is not to be regarded as an evil, since it materially aids the movement of the bowels and the ejection of their contents. It is only the presence of excessive flatulence which should be combated, especially when diseases exist in which the raising of the diaphragm must be prevented, as in heart affections. In many cases of arteriosclerosis flatulence, which is frequently present, gives rise to troublesome effects. The best treatment for flatulence consists in the rational diet above described. The best preventive measure in conjunction with the same would be that all of the food, and especially the vegetables and other cellulose-containing substances, be most thoroughly masticated, in

order that no undigested portions reach the intestine, and there form a nidus for the development of some of the countless bacilli which are ingested from the air or with the saliva or in the foods themselves.

3. *Laxative Foods.*

When one subsists—as do so frequently the well-to-do classes, living in luxury—on chicken, rice, mashed potatoes, the finer grade of green vegetables, fine pastry, and white bread, it is not a matter for surprise that such persons usually suffer from constipation. Their diet contains practically nothing capable of exercising the least stimulation for the movement of the bowels. The result is the daily use of medicines and the development of a more and more stubborn constipation. The inhabitants of Carlsbad should be thankful to all such people, for it is they who so greatly swell the number of visitors to its springs. Once their condition is improved they soon fall back into their former error, which is truly a human failing.

In this respect the working classes are better off. Their diet, which consists largely of leguminous vegetables and black bread containing much residue and cellulose, frees them of this accompaniment of wealth; they are rarely troubled with it, and in those practising vegetarianism it is practically unknown. They have plenty of bowel movements—too many, in fact; so they really represent the other unpleasant extreme. The middle way is always the best, *i.e.,* a diet containing a sufficient quantity of residue—though not too much of it—and capable of insuring the assimilation of sufficient food while the bowel movements can occur without trouble.

A diet rich in residue contains much cellulose; many green vegetable (fungi) fruits, many of the leguminous vegetables, and some cereals furnish such a laxative diet. Among such

are spinach, carrots, green beans, sauerkraut, and the cabbages; the leguminous vegetables—beans, peas, lentils—oat and rye bread (black bread), dried fruits, plums, cherries, grapes, pineapple, etc., all act upon the bowels. In the vegetables it is not only the cellulose content, but also other substances conducive to fermentation and the formation of gas, which excite the intestine to increased activity. In fruits the high sugar content and the organic acids are active in this respect. We have fully described the special action and properties of these foods, and must now refer the reader to the respective chapters concerning them. Care should be taken to have certain fruits and other foods well represented in the diet. At breakfast, in the spring, a certain quantity of cherries, all the year round honey, and certain fruit marmalades may be used. Among the latter, according to my experience, pineapple, fig, and orange marmalade, plum butter, etc., exert a good action. At noon, spinach or some others of the above-mentioned vegetables; every day, both at noon and in the evening, stewed fruit, such as rhubarb, cherries, grapes, figs, or dried plums. On retiring, fresh cherries, when they are to be had; otherwise, 4 or 5 dried California prunes, previously soaked three to four hours in water, so that the skin may be removed before they are eaten. With a good digestion they may be eaten with the skins, as they are then even more active. On rising, a glass of cold water, and, a little later, 1 or 2 fresh oranges. Before breakfast, ½ or 1 orange or a grapefruit (pampelmus). The drinking of milk—from healthy cows—and especially of sour milk, kefir, and jogurt, may also give excellent results. Plenty of exercise is a requisite. As we thus see, there are so many dietetic agents that recourse to injurious medicinal substances is unnecessary. The feces consist largely of residues which excite the intestines; if we wish to have the bowels moved, we must ingest in our food, as mentioned above, a sufficient quantity of slags or residue.

4. *Remarks Concerning the Prevention and Dietetic Treatment of Gout. List of Foods Forming Uric Acid.*

When anyone has eaten plentifully of meat during many years, he can very easily become gouty. Indeed, among such persons, especially those who lead a sedentary life and have inherited a predisposition to this trouble, very many will be found suffering from gout. It is, of course, true that one may ingest daily large amounts of uric-acid-forming foods—among which meat is one of those heading the list—without becoming afflicted with gout, provided the kidneys carry out their functions properly. As I have stated in my earlier works, gout is the result of two principal factors, the first being a diseased condition of the kidneys, with consequent lessening of their functional activity, and the second an increased formation of uric acid in the body or greater intake of this substance in the food. Retention of uric acid in the body through diminished activity of the kidneys is thus the cause of the disease. The alterations in the kidneys may be of a secondary nature, resulting from primary changes in the thyroid gland,—in which connection it should be noted that the thyroid gland itself may be a predisposing factor in gout, inasmuch as when this gland is degenerated more uric acid may be formed and gouty symptoms occur with great frequency; while, on the other hand, the administration of thyroid preparations in these conditions, as I have often had occasion to observe, will cause an increased elimination of uric acid. The liver also plays an important rôle in the development of gout. A considerable amount of uric-acid-forming substances may be taken with impunity when they are properly eliminated, that is to say, when the kidneys are active. Where this is not the case, however, one may have an attack of gout when but very little of the uric-acid-forming substances have been taken, and in some instances a gouty attack may even occur when no such substances have been

taken; this would be due to an increased formation of uric acid in the body,—the "endogenous" uric acid. This is frequently the case in lead poisoning and in all conditions where nuclein-containing substances are destroyed in the body.

From the above it follows that the action of the kidneys should be favored and improved in every possible way; this is especially necessary in advanced age or when old age is approaching, with the changes in the kidneys and ductless glands in general frequently occurring at this period, and explains the great prevalence of gout in the aged. In these cases all substances having an injurious effect upon the kidneys—especially condiments—must be eliminated from the diet. We would call attention to the chapters in which this subject has been discussed in our work on "Old Age Deferred." We might here mention that strong spices will sometimes give rise to an attack of gout in gouty patients. The activity of the kidneys may, in addition to a milk and vegetable diet, be further increased by certain diuretic mineral waters, such as the Salvator, Biliner, Contrexéville, Evian, Giesshübler, Krondorfer, etc. All the uric-acid-forming foods, *i.e.,* those with purin bases in general, must be excluded from the diet. Meat in particular, and especially that of glandular organs such as the pancreas (sweetbread), liver, kidneys, etc.; also certain varieties of fish and leguminous vegetables, beans especially, and all spices, should be prohibited. Alcohol must be strictly avoided; likewise tea and coffee, as the latter, according to the labors of Haig, Walker Hall, Umber, Schittenhelm, and others, contain considerable quantities of uric-acid-forming substances. The milk-egg-vegetable diet (together with exclusion of leguminous vegetables) is thus the best for the prevention and treatment of gout. Milk and its products, most varieties of cheese, eggs, caviar, cereals, various flours, with the exception of that of oats—as oats contain purin bases, 0.021 per cent. in the flour—and also a large number of green vegetables, are all free of

purin bodies or contain them only in small amount. This may be observed in the subjoined list; gouty patients should therefore, if possible, limit themselves to the foods above named. I might still add, however, that, as I have already stated in earlier works, there is probably a difference between animal and vegetable purin bases in regard to their effects in the body, just as vegetable albumin causes less secretion of sugar in diabetes than the animal varieties. Fish would no doubt be better tolerated than meat. A list of various foods and their content of purin bases, after Bessau and Schmidt, is on the next page.

As with tea and coffee, alcohol should be only very sparingly used by gouty patients even in the intervals between the attacks. A light white wine would, however, not be injurious. While the stronger varieties of wine may in certain quantities bring on mild attacks, one is not insured against them even when the greatest moderation is exercised. Naturally, the danger is increased if one is imprudent in the matter of eating and drinking. Thus, Sydenham, "the English Hippocrates," spoke truly when he said: "When you drink wine, you get the gout; when you do not drink it, you also get it."

5. *Practical Hints for the Prevention and Treatment of Obesity. Dietetic Measures.*

In order to fatten a goose it is kept in a dark place, in a small cage in which it cannot well move about, and stuffed with food, a procedure which is resorted to in Alsace, Belgium, etc. In some places they even go so far as to fasten down the feet so as to prevent all motion. Geese treated in this way get very large, and the liver especially becomes exceedingly fat. When anyone eats a great deal, particularly of very nourishing substances—as is the case with geese, which absorb fats, carbohydrates, and albumin in their corn, and these substances are better assimilated than is the case in man—he will grow fat.

In 100 grams of	Substances forming uric acid (purin bases).	In 100 grams of	Substances forming uric acid (purin bases).
Beef	0.037	Limburger	traces
Veal	0.038	Gervais	—
Lamb	0.026	Cream cheese	0.005
Pork	0.045	Milk cheese	0.022
Boiled ham	0.025		
Brunswick sausage	0.010	*Leguminous Vegetables.*	
Blood pudding	—	Fresh peas eaten with pods	0.027
Brain	0.028	Peas	0.018
Liver	0.093	Lentils	0.054
Kidneys	0.080	Beans	0.017
Calves' sweetbread	0.330		
Chicken	0.029	*Vegetables.*	
Squab	0.058	Cucumbers	—
Goose	0.033	Salad	0.003
Venison	0.039	Radishes	0.005
Pheasant	0.034	Cauliflower	0.008
Bouillon, 100 grams of beef, boiled two hours.	0.015	Spinach	0.024
Fish.		White cabbage	—
Haddock	0.039	Carrots	—
Eel	0.027	Kale	0.002
Cod	0.038	Rampion	0.011
Salmon	0.024	Kohlrabi	0.011
Carp	0.054	Celery	0.015
Perch	0.045	Asparagus	0.005
Pike	0.048	Onions	—
Herring	0.064	String beans	0.002
Trout	0.056	Potatoes	0.002
Sprat	0.082	*Fungi.*	
Sardine	0.020	*Boletus bulbosus*	0.018
Lobster	0.020	*Cantharellus infundibuliformis*	0.018
Oysters	0.029	Mushrooms	0.005
Kaviar	—	*Morchella elata*	0.011
Hens' eggs	—		
Milk and Cheese.		All fruits	—
Milk	—	Cereals	—
Edam cheese	—	Bread	—
Swiss cheese	—	Pumpernickel	0.003

This can be avoided, however, by taking plenty of exercise, and it is not very likely to occur when there is not a predisposition to becoming stout. The foods which contain a great deal of fat not inclosed in cells, but free and ready to be absorbed, are those which chiefly increase the body fat, such as butter, oil, etc. The carbohydrates, sweet foods, candies and sweets of all sorts, are also fat producers, because large quantities of sugar are absorbed in them. In pastry and farinaceous foods this is especially the case when they can be readily absorbed like tapioca and sago, in which the absorption and the taking up into the blood are not interfered with by any cellulose. The fat formation is increased when carbohydrates and fats are taken together, and particularly when in combination with alcohol. Obesity is sure to occur when plenty of meat is also used. When only a small quantity of meat or of albumin is taken, obesity is not apt to occur. True vegetarians scarcely ever grow fat, but this is more likely to occur, according to my experience, when a milk-egg-vegetable diet is used. No matter how large the quantity of meat, it will probably not cause excessive fat; on the contrary, with a diet consisting largely or, rather, almost entirely of meat, a decrease of fat will occur, as is shown by the obesity cures. When, on the other hand, there is a sufficient quantity of meat, viz., albumin, in the diet, and plenty of starchy foods and fats are also taken, then obesity is apt to occur. This shows that the quantity of albumin, especially that contained in meat and eggs, must be diminished in the diet. When little meat is eaten, more carbohydrates, *i.e.*, farinaceous foods, may be absorbed. Otherwise, they, and especially milk, cheese, fatty foods, and butter, are strictly to be avoided. Sweets and alcohol are never allowed. The carbohydrates may be preferably given when ingested in foods containing much cellulose, as, for instance, the leguminous vegetables, as they are then not so well assimilated. In order that there shall be no hunger, and consequently

no desire for more nutritious foods, it is customary, at the beginning of the treatment of obesity, to allay the hunger by such foods as contain but little carbohydrate and plenty of cellulose, and are likewise bulky, such as sauerkraut, certain kinds of fruit, all vegetables, rye bread, and pumpernickel. In this way the patient lives upon foods which are not fat producers, and yet has plenty in the stomach. The best dietetic treatment as well as the most certain preventive of excessive fat is, in my opinion, a diet of this kind, without milk or eggs. If this diet is not helpful, as in cases where there is a constitutional obesity, due to alterations in the thyroid gland, the ovaries, or other ductless glands, either acquired or inherited, then the best treatment is by means of tablets of thyroid extract and, in the case of women, ovarian extract as well. When the obesity is due to overnutrition I have often seen good results after treatment with thyroid extract, which is, in my opinion, the most satisfactory in obesity. According to my many observations—even some upon myself—I do not consider it at all injurious, if the patient is carefully watched by a physician who is familiar with the effects of ductless-gland preparations.

6. *Concerning Fattening Foods. Fattening Treatment.*

When anyone wishes to grow stout he will do well to ignore all that has been said in the preceding article on obesity. That which principally causes obesity will be well adapted for him. Milk and, particularly, cream and butter are easily digested and readily assimilated fatty foods. In my own experience I can say that I have not met with a single case in which I was not able to increase the weight of the patient when using large quantities of the good rich milk which I have at my disposal here in Carlsbad, together with cheese and an ample quantity of meat and carbohydrates.

Rich milk is well adapted for a fattening treatment, and is best when mixed with cream, as I am in the habit of doing; I also order cream to be taken with zwieback, and plenty of butter on white bread or zwieback,—also 4 to 6 eggs daily; fat meats, such as goose, duck, pork, and fat chickens—when two kinds of meat are eaten at midday, the lean meat should be first eaten and afterward the more fatty one—together with tapioca or rice. For those who are fond of potatoes, they may be prepared as a *schmarren,* then some flour food with plenty of sugar and cream; ¼ of a liter of dark Bavarian beer or a little sherry, port, or Malaga wine (such patients are often convalescents after some exhausting disease, or persons predisposed to tuberculosis, etc.). Instead of beer or wine, milk would be more healthful and fattening. To improve the taste of the milk, and make it even more fattening, the yolk of an egg and two teaspoonfuls of cream may be added to each glassful. I find it very advantageous when a handful of raisins or currants and 1 or 2 pieces of dried banana are taken after the midday and evening meal. They are readily tolerated and very fattening.

From 1 to 1½ liters of milk and ½ liter of cream should be taken daily in the manner above described. At each meal plenty of butter should be eaten, and at noon and in the evening cream cheese (Gervais). In persons who tolerate milk well, fattening treatment is invariably successful when a combination of foods as described above is made use of daily. In the intervals between meals it is not advisable to take anything except milk, perhaps mixed with a little cream, and a single piece of zwieback. I lay great stress upon the use of raisins, dates, figs, or dried bananas, and chocolate at the end of the meals. I find that dried currants and seedless raisins are better tolerated than the other dried tropical fruits, except perhaps the banana. Little exercise should be taken, but the patients should be in the open air (in the shade) as much as possible.

CHAPTER VII.

HINTS FOR THOSE OBLIGED TO TAKE THEIR MEALS IN RESTAURANTS. THE INJURIOUS EFFECTS OF THE "TABLE D'HOTE" DIET.

He who, like the author, is, as a bachelor, so unfortunate as to be obliged always to eat in restaurants, and during the winter when on long journeys must visit the hotels of various countries, can surely expatiate on his experiences. It is not at all surprising that bachelors, as I have already stated in my book on "Old Age Deferred," are doomed to a short life, for, as we shall now see, they are subjected to a series of injurious experiences which may be of considerable importance. That cats and dogs must masquerade as rabbits and other game in the diet list is in itself repulsive enough, and leaves an unpleasant after-taste in the mouth of the lover of legitimate game, but the nutritive value of the meat itself is not diminished for those who are subjected to this martyrdom of the unfortunate animals. When this sort of "game" is fresh and is well prepared, and does not have a sauce made with bad, rancid butter, no damage will, as a general thing, result for the stomach and intestine of the consumer. We have, however, already referred to the fact that injurious effects may follow after eating the meat of animals having become saturated with secretions thrown out through fright previous to the death of the animal.

That the meat of such animals is actually made use of in the kitchens of establishments of a very inferior order—and sometimes even in those of a rather better grade—in many

large cities is proven by the court trials, when such "hunters" are captured with the products of their chase—dead cats and dogs—which they have in their bags and are offering for sale (as I recently read in a foreign newspaper). It is, indeed, much better when we simply devote our attention to our food without attempting to study details as to its origin. I greatly fear that not only I, but also a great many others, would then be minus their psychic gastric juice, and the food would consequently lie longer and heavier on our stomachs. With very sensitive and nervous persons the food would leave the stomach by the way it had entered, if its origin and consequent treatment were to be made known to them immediately after its ingestion. How fortunate it is that we are kept in ignorance! The poet says: "Der Mensh versuche die Götter nicht und begehre nimmer zu schauen, was sie gnädig bedecken, mit Nacht und Grauen." (Man must not question the gods and ask to see that which they have kindly covered with the shades of night.) What would many a delicate and fastidious lady say if she knew that the most juicy and fragrant strawberries are those which have been grown when the very fattest cow-dung and perhaps even human excrements—as is done in some European countries—have been spread over the strawberry beds? When the rain falls the salts contained in this manure are carried into the earth, to be again taken up by the strawberries, which thus develop into the very finest berries.

As stated in the Holy Scriptures, even in the matter of human foods, the lowest shall become the highest, and when we eat the meat of a well-fattened ox we absorb from this meat the salts which the animal obtained from the vegetable food eaten by it; the plant again thrives best upon the manure furnished by the evacuations of animals and of man, and by the excrements of birds—sent from Chili and Peru. The meat of the fat pig is also formed from substances with which we had better not busy ourselves too much. Nothing is lost in

this world, and there exists an everlasting circle which carries the salts coming from man into the earth, from the earth into the plant, and from the plant again to man, either directly or through the intermediary of the ox or the sheep.

While therefore for esthetic reasons we would do better not to enter too deeply into the question as to the remote material of which our food is composed, we nevertheless have every reason, in consideration of our health, to acquaint ourselves as far as possible with the food substances furnished to us and prepared in the restaurant kitchen. We will proceed most safely if we give the preference to such foods which show by their appearance just what they are, viz., meats roasted upon the spit, or, at all events, such as are not covered by a crust or a thick sauce in order to hide their defects. It is impossible to say what may be beneath such a crust or thick cream sauce in certain restaurants of a very low order, or what kind of meat has been used in some of the dishes in which it is very finely chopped. Very often one fares badly with the sauce or gravy which covers the meat, and it not infrequently happens that in some of the cheapest places the butter used for cooking is not irreproachable; rancid butter gives rise to many digestive disturbances. It is easy to understand that the proprietor, who must also make some profit, cannot, when the meal is furnished at a very low price, provide the best and most expensive foodstuffs. Especially when traveling, and at large public festivals where many thousands of people frequent the restaurants, it frequently happens that the health is seriously affected by defective foods. It is therefore wiser to provide one's self with the necessary food at some familiar place and to eat this fresh and cold. It is usually much the best plan to eat at some well-known restaurant, and where one is also known; one should as much as possible eat in the same establishment, and not change about from place to place. In Austria-Hungary one generally finds very good cooking every-

where; the coffee especially is always good. This, unfortunately, is not the case in Germany, owing to the fact that in that country it is the custom to take the meals at a fixed price, whereas in Austria-Hungary one almost always eats *à la carte,* selecting what one wishes and having it freshly prepared. The bills of fare in Germany frequently consist of large quantities of meat, but its quality as well as that of the rest of the foods in the beer taverns often leaves much to be desired. In the wine restaurants in Germany the food is excellent. What is to be done, however, by those who do not wish to drink wine? Fortunately, we are not thus compelled to drink wine in Austria-Hungary. One can eat there at the finest hotels and take simply a glass of beer or a small bottle of mineral water. Whenever possible, we should not eat food which is ready, but should select something which will be freshly prepared.

With regard to some of the vegetarian restaurants I cannot, according to my personal experience, give a very good account. Their device, unfortunately, seems to be "cheap and plenty." The result for the stomach may be imagined. In Germany especially it is very difficult to find in certain cities a vegetarian restaurant of a finer class where the above principle does not seem to be the chief one. The fault, to be sure, does not lie with the restaurant, but with the public. For as long as vegetarianism continues to be principally followed by the poorer classes it will be difficult to establish first-class vegetarian restaurants with a selection of finer vegetarian foods, choice fresh vegetables and fruits. It would be well if the owners of vegetarian restaurants would first have to pass an examination in cooking; in fact, this should be required of all hosts by the authorities. In vegetarianism a thorough knowledge of the science of cooking is a prime requisite; otherwise, the nutritive content of the foods will not be properly made use of. In the large German cities there are some really

good vegetarian restaurants. I found one of this kind in Leipzig (Pomona), where the cooking is very good; the same may be said of the Pomona restaurants in Holland, with one of which, that at the Hague, I am familiar. In Belgium there is also a series of good vegetarian restaurants, but the finest and most luxurious vegetarian cuisine is to be found in London and Manchester.

When we consider what great damage may be done in regard to public welfare by restaurants of an inferior order—leaving aside the question of the often very insanitary building conditions—it would certainly be justifiable to have all restaurants inspected once or twice a year by an authorized commission, an arrangement which would probably not be objected to in the least by establishments of the better classes. It would be of the greatest benefit for the public health if the authorities would look strictly into the question as to what really is brewed in the "witch kitchens" of the lowest order for the poor, hard-working people. Since such a commission exists for the inspection of drug-stores, in order to test the remedies which are sold to the sick, I see no reason why it should not likewise be seen to that nothing which would impair the health should be sold to those who are well. In this connection, I am especially desirous of calling attention to the serious injury which may be done to our health when falsified foods, sometimes containing strong injurious drugs, are put before us. The food chemists, by revealing these frauds, are rendering incalculable service, and we are surely not saying too much in stating that the average length of life of the people depends in great measure upon them. I would again particularly emphasize the fact—as I have already done several times in this work—that the deleterious effects of these injurious, falsified foods do not at once become evident—and this is just the source of the danger—but slowly and stealthily cause degeneration of some of our principal organs, especially the

kidneys, thus shortening our lives. And what of the punishment for such an offense? It is ridiculously slight.

When anyone does a person an injury he is frequently punished by imprisonment during a number of months, but when anyone injures not only one but a very great number of persons—and this in an underhand way—by means of spoiled and falsified foods preserved with injurious substances, in such a manner as to undermine the health for months and perhaps even years, and thereby shortening life, he is punished in Austria-Hungary by a fine of 100 kronen! And yet several crimes are here combined: premeditated, underhand bodily injury; deceit, falsification—all with the object of gain—and this not only in respect to one person, but to innumerable people. The proper punishment for the falsification of foods would be an average of the punishments meted out for the various crimes above mentioned.

The owners of eating-houses and restaurants are, to be sure, helpless in the hands of these falsifiers. The best remedy would be the enactment of a law making it obligatory to state, in regard to every food substance: (1) whether it is absolutely pure; (2) what admixtures it contains, and, if possible, also the quantity thereof. The substitution of one food for another and the selling under a false name should also be prohibited.

Eating in restaurants may also have an injurious effect because very often too many foods are offered, especially at "table d'hôte" meals with a long menu. In hotels of an inferior order it not infrequently happens that on the menu meats are served which were left over from the previous day. Even in the very finest hotels the "table d'hôte" with its endless menu is always a serious danger for the health, even when the foods are well prepared and the taste is good—in fact, perhaps for this very reason. There are, unfortunately, very few persons having sufficient strength of will not to eat

a series of good appetizing foods placed before them, especially when they have "paid out their good money." When anyone lives in a fine hotel on the Riviera and is given for lunch 2 or 3 dishes of fish and meat, and for dinner in the evening 3 or 4 kinds of fish and meat, very often including some game (even in the spring), it can readily be understood how greatly all the principles advocated in this work are being sinned against. That such unrestrained "rapacity" does actually shorten life when long continued is not to be doubted. It is therefore indicated to eat *à la carte,* a habit which is fortunately quite general here in Carlsbad, and in fact throughout Austria-Hungary (with the exception of the Tyrol). In selecting from the bill of fare, everyone can take just such food as is best adapted for his constitution and his health in general.

Even in the very finest restaurants one will often not dine as well as at home, when one has the good fortune to be married and when the housewife herself selects the very best and freshest foods in the market, which are then prepared for the family table with the most healthful and best adapted accessories. The above remarks go to prove the correctness of the statement made by the author in his work on "Old Age Deferred," that a married man will live longer and remain in better health than a poor bachelor.

CHAPTER VIII.

THE INCREASED ACTIVITY OF CERTAIN FUNCTIONS BROUGHT ABOUT BY FOOD.

1. *Concerning the Increase of Intellectual Activity Brought About by a Suitable Diet.*

THAT the intellectual capabilities of man are greatly influenced by his food is a truth which probably cannot be disputed by anyone. We see this exemplified in those aggregations of people who nourish themselves in a sparing and penurious way, and whose intelligence consequently remains of an inferior order. The natives of the Bismarck Archipelago and of the Solomon Islands furnish an instructive illustration of this fact. As Thurmwald has recently stated in the *Zeitschrift für Ethnologie,* they probably stand on the lowest plane of intelligence. Some of them are not even able to count up to twenty. They are so helpless that they would prefer to walk around a piece of wood happening to lie in their way than to move it away. According to Thurmwald, they show a remarkable slowness in thought association and are totally lacking in prudence or foresight. Their food consists principally of taro, a starchy flour on the order of manioc.

When, on the other hand, we consider the people who live upon an ample mixed diet, with plenty of nitrogenous foods and much meat and fish—like the English and Americans—we find them on the average of a high degree of intelligence, many of them being remarkably gifted: they are possessed of a wealth of creative ideas and practical inventions, with an initiative such as is perhaps not possessed by any other nation.

We may involuntarily ask ourselves, Does not this perhaps depend upon a difference in the food? Does not, perhaps, the quantity of nitrogen absorbed in the nourishment, which is so poorly represented in the diet of the native tribes referred to above, cause this difference? If we consider the experiments of Forster we must reply in the negative. This observer fed a dog upon meat which had been thoroughly soaked in water, together with plenty of carbohydrate and fatty foods, from which the nutritive salts had been carefully extracted. Notwithstanding the fact that the nutritious substances, strictly speaking, were not lacking in this food, a great falling off of the intelligence together with other symptoms of degeneration were noticed in this dog, although he had been having plenty of nitrogen.

Something was missing in the food—and this was the nutrient salts! We must consequently ascribe the striking deterioration in intelligence noted to the absence of the nutritive salts. The question then is: Which of the salts is responsible for this? It is evident that, in the presence of alterations of the functions of the brain, we must have to deal with a salt which exists in considerable quantities in the brain, for—as has been said so often in this book—like begets like. If we wish to stimulate the activity of certain organs we must—as is done when fertilizing plants—administer those salts which are contained in it and which it requires. The most important of these salts are those containing phosphorus and lime,—especially the first named, for with it the lime content can be influenced and increased. That the amount of phosphorus contained in the brain plays an important rôle in the development of mental affections we have already mentioned. In idiocy and in dementia præcox Marie found a decrease of the phosphorus in the brain. It is a fact of the greatest importance that the portion of the brain which plays such an important part in the intellectual processes, the gray matter, yields, in the

ethereal extract made from it, more phosphorus than the white; Petrowsky also found in it double the amount of lecithin. Lecithin, as is well known, produces glycerin and phosphoric acid when decomposed. Phosphorus is absorbed with lecithin, and the brain substance is rich in phosphorus and lecithin.

It is also an observation of great significance, with regard to our powers of resistance, that wherever there is an undue elimination of phosphorus nervous and even mental disturbances occur. In some cases, as, for instance, in osteomalacia, the condition can be improved by the administration of phosphorus, which has a favorable effect upon calcium metabolism. If in some instances the administration of phosphorus produces no effect, this must be attributed to the fact that, while it does act favorably in making up for the deficiency of phosphorus, another factor which is likewise of the greatest importance, viz., increased activity of the thyroid gland, which regulates phosphorus metabolism, has not been taken into account. That a pronounced lack of phosphorus in their food is responsible for the very low grade of intelligence exhibited by the natives of the Bismarck Archipelago—for their principal food, taro, contains very little of this substance—is, according to the above statements, not unlikely, just as the great intelligence of the English and Americans may be ascribed to the large amount of phosphorus contained in their food (they eat meat three times a day, together with much fish, eggs, and green vegetables). The frequency of gout also stands in relation to this diet. That food which contains the greatest amount of phosphorus is also the one which is rich in nucleins—uric acid producers. Animal foods are not only rich in these substances, but more organic phosphorus is also absorbed from them than from a vegetable diet, since in the latter the phosphorus, owing to the large lime content, is eliminated in an insoluble form from the intestine.

We must not flatter ourselves in the belief, however, that we grow in intelligence when we eat much meat, small fish, eggs, etc. The matter in question is not quite so simple. The effect as far as we are concerned would be about the same as in a bottomless barrel. We might take any amount of phosphorus, and it would simply pass through our bodies without our deriving the least benefit from it, if it were not retained by certain organs. One such organ which has—as we have already shown—a governing influence upon the metabolism of phosphorus is the thyroid gland. For the subject in question it is of importance to note that the intelligence of a person depends upon the perfect action of this organ, as I have already shown, in my work on "Old Age Deferred," by means of a series of experiments. Suffice it for me to state here that when the thyroid is degenerated the intelligence is considerably impaired, or, indeed, is entirely lacking, as in the cretin. When such individuals are treated with thyroid extract, and when a plentiful diet is also taken, the intelligence is greatly improved; in fact, wonders may be performed in this direction. I am of the opinion that thyroid treatment improves the intelligence because through its agency the phosphorus taken in with the food can be better assimilated. This opinion is undoubtedly fully justified, according to the above statement, as we know that the thyroid gland regulates phosphoric metabolism. Moreover, I have generally found evidence of a much better assimilation of phosphorus in analyzing the urine of persons treated with thyroid extract. That the metabolism of calcium is also increased is shown by the astonishingly rapid growth of previously stunted children. They develop both in body and in mind. I have also noted in adults—in myself for instance, as I state in the work already named—a very striking effect upon the intelligence, and the memory in particular, when thyroid extract was being taken. Among the cases in which I observed this effect I would like to cite that of a chemist, 35

years old, who while being treated in this way, in addition to showing various other indications of an improved memory, was able to recollect the word "Penthatlon," which he had been trying in vain to recall during many years. The well-known experimenter with thyroid extract, Hertoghe, observed similar effects upon himself when following such a treatment.

In consideration of all that has been said above, and in Chapter I, section 2, and Chapter II, section 2, we are driven to the conclusion that the intellectual capacity of man may be increased (1) by taking as much as possible of foods rich in phosphorus, and (2) by exercising care that the thyroid gland, upon which the proper use and assimilation of the phosphorus are dependent, may be able to carry on its functions in a normal manner. According to the labors of Cronheim and Müller, Schaumann, and others, the organic phosphorus compounds are best adapted for this purpose—especially the nuclein-phosphorus-containing foods, as has been shown by O. Loewi, Schaumann, and Jebbink. It is of primary importance, however, that these foods be intelligently prepared, and not soaked or boiled out through overcooking at a long-continued high temperature, and in this way or by pressure, etc., deprived of their important nutritive salts. We have already shown how very harmful this is. The foods rich in phosphorus have already been mentioned.

The activity of the thyroid gland may be effectually stimulated by following certain dietetic regulations which have already been referred to. We shall merely mention here that a certain amount of meat in the diet may act in this way; roast meat is preferable to that which has been robbed of its extractives. Several other hygienic rules having nothing to do with the question of diet, and likewise the stimulation of the activity of the thyroid gland by extracts of the same gland obtained from animals, have been emphasized in our above-mentioned work. Great care must be exercised in such treat-

ment, however, for if the thyroid gland becomes overactive much damage may be done. When, too, this gland is not functionating adequately, certain precautionary measures must be observed, for which the reader must be again referred to my work on "Old Age Deferred."

The activity of certain other ductless glands which also greatly influence the phosphoric metabolism, *i.e.*, the sexual glands, must likewise be regulated. When alterations have occurred in these glands, psychic disturbances will frequently be observed, as at the age of puberty, in pregnancy, and at the period of the climacteric. I would also call attention to the very frequent psychic disturbances in diseases of the ovaries, after castration, and particularly the melancholia of the castrated male, in varicocele, etc. As mentioned in my above-named work, I found a goiter coexistent in several cases of melancholia and dementia præcox, as well as alterations of the thyroid and sexual glands. This summer I had occasion to observe a very interesting case which I shall publish in detail later on. The patient was a 14-year-old French boy suffering from obesity and defective development of the testicles; he weighed 74 kg. He had the appearance of a eunuch, and his intelligence was somewhat impaired—apathetic. The testicles could scarcely be felt, and there was almost no hair on the pubis or on the lip. I first treated him with thyroid, and afterward with testicular extract. The result was surprising. The boy grew several centimeters in height, hair appeared upon his lip and over the pubis, the testicles grew larger, and erections took place at night and also during the day, while previously there had not been the slightest symptom of any sexual impulse. He was made a man! The intelligence was developed to such an extent that he wanted to read all day long and interested himself in problems of all sorts.

That the intelligence is greatly influenced by the sexual organs has been demonstrated in our above-mentioned work,

in which the inferior mental attributes of eunuchs were compared with those of celebrated men like Goethe, Victor Hugo, and others, who had a decided predilection for the fair sex. Since thus the sexual glands also exert a governing influence upon the phosphoric metabolism, we are forced to conclude that their influence upon the intellect takes place just through this action upon the phosphoric metabolism, a fact which will probably not be disputed by anyone. The hypophysis probably also exerts a considerable influence on the phosphoric metabolism, as shown by the works of Moracewsky and others. The increased intelligence cited by various authors as occurring when there is overactivity of the hypophysis—in patients suffering from acromegaly—is remarkable.

As a result of the facts submitted above and in Chapter I, section 2, and Chapter II, section 2, I am led to a therapeutic conclusion, which, owing to its astonishing reach, I advance with considerable diffidence, viz., that if certain mental diseases, in which very frequently no anatomical changes are noticeable, are caused by a more or less defective phosphorus metabolism—which according to the above statements appears to be the case—one could, by the administration of a great deal of nuclein-phosphoric acid in the food, together with a treatment with thyroid—ovarian or testicular extracts, according to the nature of the case—cause a very great improvement and possibly a complete recovery. Indeed, the administration of thyroid and ovarian extracts in certain mental affections has already caused a decided amelioration of the symptoms. I have myself seen such results in several cases of melancholia. When in other cases, however, no successful results were obtained, this might perhaps be ascribed to a defective diet. It seems therefore to be indicated that a considerable quantity of phosphorus be administered, together with these organic preparations. Certain cases of polyneuritis and epilepsy have lately been published in which the adminis-

tration of phosphorus was attended with beneficial results. Lecithin (Buchmann) has a similar effect, as it causes the retention of phosphorus, as was shown by Slowzoff (and confirmed by Joshimoto). Such favorable results would no doubt also occur in mental diseases, if phosphorus and organic preparations were simultaneously administered.

2. *Hints Concerning the Diet of Brain Workers.*

When Albrect von Haller, the great physician of the eighteenth century, was for a time subsisting upon a strictly vegetarian diet, he felt great muscular weakness, a decided depression of spirits, and was unable to do any mental work. (As a proof of Haller's intelligence, I would call attention to the fact that at the age of 5 years he was explaining the Bible to his father's servants, and at 12 years wrote a Greek grammar.) Results similar to the above are often noticed. Personally, I experienced the same effects after a long-continued vegetable diet. Undernutrition often leads to excitability of the nervous system—many cases of nervousness, neurasthenia, and hysteria are improved by a plentiful diet—and the disinclination for mental labor may perhaps be due to this. According to the statements in the previous chapter, the lack of phosphorus may possibly be the chief factor in such conditions, since the nervous system cannot properly carry out its functions without a sufficient quantity of phosphorus. As already stated, the phosphorus of animal origin is better assimilated; in a vegetable diet much of it is lost in the intestine. Fish is preferable to meat, since, according to the recent works of Slowzoff, the salts are more readily absorbed from it and the phosphorus content in the body is therefore increased. Up to the present the impression has prevailed that the amount of phosphorus in fish is small; but when we study the analyses of Balland and Jebbink, it will be seen that some quite small fish

have a particularly high phosphorus content. According to Balland, fried gudgeons contain more of it than perhaps any other food substance, the natural substance containing 0.82 per cent. of phosphorus and 0.90 per cent. of phosphoric acid; thus more than twice the amount in meat. The same is the case in some other fish varieties, according to Jebbink. The experiments of Schmidt and Bessau also show that the smaller fish have a high nuclein content and consequently contain much phosphorus. Leguminous vegetables and cereals are likewise rich in phosphorus—according to Balland, they surpass many of the small fish in this respect—but a considerable portion of this substance passes through the intestine unused when a pure vegetable diet is partaken of. There is probably no article of food poorer in phosphorus than the fine white bread so much used by the wealthier classes, and Aron and Hodgeson have shown that monkeys gradually weaken and die upon such a diet. The same was the case with the animals of Forster, Eickman, Axel Holst, and others when fed upon food lacking in phosphorus. We must not imagine, however, that an untalented writer will become a Victor Hugo if he continually feeds upon fish, eggs, meat, and cheese and leguminous vegetables in particular, since the intellect does not only depend upon this, but also upon the condition of certain organs which exert a great influence upon the phosphorus metabolism. The American humorist, Mark Twain, wrote to a young writer of average capability—who had asked his opinion in regard to some of his writings—that he would do well to eat a whale every day, by which means he would become a celebrated author, since it was said that a fish diet had a stimulating effect upon the mental attributes.

At all events, a fish diet is efficacious in mental labor owing to the fact that it is very easily digested; this is of great importance, for after a plentiful meal of meat one feels heavy and brainwork is accomplished with difficulty. The same may

be said of any very full meal, especially if the food is difficult to digest. During the digestion more blood flows to the digestive organs—as it does to any organ which is at work—and consequently less to the brain. While an overabundant diet may be injurious, an insufficient one is much more so, since the quantity and quality of the blood, as well as the circulation of the brain, suffer thereby. Moreover, a great loss of phosphorus always occurs in undernutrition. It will thus be readily understood what serious injury is inflicted upon growing school children when they are allowed to go hungry. When, therefore, the State renders attendance at school compulsory, it should likewise see to it that every child be properly nourished. A starving school child puts the modern State administration to shame. When there is a question as to who should do without food, it should rather be the father than the child who is obliged to study. The poor, hollow-cheeked student, who has not enough to eat and who has many difficult subjects to study, is one of the greatest reproaches to our civilization and culture. If such children were given a certain amount of food at the expense of the State, the money spent for this purpose would be returned a hundredfold, when we consider that in this way very useful citizens would be trained, and much money now spent for the maintenance of hospitals, workhouses, and prisons would be saved. Unfortunately, so many provisos of the modern State government are reparative, but not preventive. Millions are spent where as many thousands would have sufficed if matters had been attended to in time.

By innumerable trials upon cretinous school children, it has been made clear that they are markedly benefited by the thyroid treatment. Possibly the results would be even more satisfactory if phosphorus and lime were to be administered at the same time in the food. Such a diet would even be indicated for normal children, as the physical growth is likewise

increased by it. As an important constituent of this diet should be included bread made from whole wheat, which is more rich in phosphorus. The thyroid gland cannot stimulate either the intelligence or growth, if there is not at the same time a sufficient amount of phosphorus and lime in the food.

The diet of a brainworker should be one adapted to the nature of his work. In view of the considerations already presented it would perhaps be advisable to make experiments for the purpose of elucidating how certain kinds of mental labor are affected by various foods. When creative work is to be done—the formulating of new, original ideas—a meat and fish diet, with eggs, cheese, and green vegetables, might be the best. Thus, for musical composers, writers, etc., such a diet, with meat and fish once a day, would be indicated, as well as for scholars who are endeavoring to elaborate some new creative ideas. When it is desired, however, to work untiringly with a clear head and quiet mind in carrying out the details of an already established program, no other diet is so suitable as the milk-egg-vegetable one, with meat excluded, or a purely vegetarian diet. For a merchant who wishes to speculate or carry out some new undertaking, a diet with meat and fish once a day is well adapted. Bookkeepers or cashiers, who must work at figures with a clear head, as a mistake made might cause great damage, will do well with a vegetable diet, and the same will be the case with officials, providing they adhere strictly to the one *régime*. Their industry would greatly exceed that of the meat-eaters. Even the "boss" would do better on a milk-egg-vegetable diet, and would frequently lose less in his speculations and combinations. As an illustration of the above in the animal kingdom I would like to mention the fact that a hunting dog which must scent out and point the game should be given some meat every day in order successfully to perform his task. For the cart-dog, which sometimes has to pull about quite heavy burdens, more carbohydrate food

is required, although some meat would also be advantageous. Physical labor is principally carried on at the expense of the carbohydrates, whereas mental work cannot be accomplished without a sufficient or rather an abundant supply of albumin. According to Pflüger and Rubner, albumin is the greatest producer of energy.

I cannot imagine such a man as Napoleon living upon a purely vegetable diet, and I think that everyone will agree with me. It certainly was not the case, and he was a very impulsive eater. He ate at all hours, and food had constantly to be kept prepared and ready for him; he was most surely not a methodical, temperate man, as he might have been upon a vegetarian diet, but a true genius!

From these considerations it follows that for nervous, restless persons and for quiet, methodical mental work no diet is superior to the vegetarian. For the pursuit of new fields of endeavor, the creation of new inventions, etc., this would, however, probably not be the case.

It is exceedingly difficult to generalize, and in this still rather obscure field we must be especially careful in coming to conclusions. One thing is certain, however, viz., that where mental work is to be accomplished moderation in eating and drinking is necessary. It would be advisable rather to eat more frequently than to wait until ravenously hungry and then eat too much, thus rendering one's self heavy and unfit for any work. It is best to take a glass of milk, with a little cream and the yolk of an egg added; for when we consider how rich in fat the brain (up to 8 per cent.) and the nervous system (21 per cent.) are, we should—if the principle that for the proper functioning of an organ the substances in which it is rich should be administered in considerable amounts is correct—take plenty of milk, butter, and eggs while mental labor is being carried on, since the organs in question contain much lecithin.

When the milk-egg-vegetable diet—which is in the aver-

age case the proper one, except under the circumstances above mentioned—is used, milk, oatmeal gruel, or some other of the breakfast dishes previously referred to, such as eggs, fruit (cherries), etc., should be taken. At noon thick vegetable soups, eggs, cheese, vegetables, macaroni, milk, stewed fruit are suitable; in the evening, eggs, cheese, vegetables, macaroni, or rice. Altogether this gives an average daily of 4 to 6 eggs, 1 to 1½ liters of milk, with cheese, macaroni, rice, sago, green vegetables, and fruit (nuts, raisins, dates, and fresh fruits). When, for the reasons mentioned, a mixed diet is taken, meat may be eaten at noon and fish in the evening. As a beverage cocoa, which is especially rich in phosphorus, should be used; this was the favorite drink of the great Swede, Karl Linnæus (Linné).

3. *The Increase of Sexual Activity by a Specially Adapted Diet.*

Since the most remote periods of the existence of man, the eating of fish has been accredited with the property of increasing sexual activity. It was for this reason that the old Egyptians forbade the eating of fish by the priests.[1] There must be some truth in this, since the idea has persisted up to the present time. Brillat-Savarin, in expressing his belief in this property of fish, cited as an example the notoriety achieved in this direction by the members of several clubs the rules of which forbade the use of meat and required that fish be eaten every day. They acquired the same reputation, says Brillat-Savarin, as that enjoyed by Hercules with the daughters of Danaus ("elles finirent par donner à eux une réputation semblable à celle d'Hercule chez les filles de Danaus ou du Maréchal de Saxe auprès de Mademoiselle Lecouvreur"[2]).

[1] Wilkinson: *Loc. cit.*, p. 23.

[2] Brillat-Savarin: *Loc. cit.*, p. 353.

He also referred to the story of the Sultan Saladin and the two dervishes. As the guests of the Sultan, the latter were served with an abundance of meat; he also gave them two odalisks, who were, however, unable to seduce them. They escaped from this temptation "as pure as the diamond of Visapur." When later the Sultan fed his guests for several weeks almost exclusively upon fish, they were no longer able to follow the example of St. Anthony of Padua. Both of the holy men fell victims of a fish diet. Davy[1] also mentions the striking fact that fish-eating populations have a very numerous progeny. As he says, no other people are their equals in this.

Other articles of diet, particularly eggs and caviar, are also generally supposed to exert a stimulating action upon sexual activity. It is customary to say, *vox populi vox Dei,* and as far as foods are concerned I would be inclined to consider that in the case of such empiric beliefs, which have been handed down to us from time immemorial, even medical science—which has undoubtedly frequently profited by such statements—should not pass them by without notice, as there might possibly be something in them. It seems to me quite certain that a plentiful diet containing, in particular, much protein would have an excitant influence upon the sexual function. We are familiar with the fact that the male sexual glands, when they are well filled, exert a certain stimulus upon the sexual sensory centers. The heads of the spermatozoa, like cell nuclei, consist chiefly of nucleoproteids. When a considerable amount of food rich in nuclein is absorbed in the diet, the spermatozoa become more numerous and are more apt to exert an exciting effect, but when these nuclein bodies are absorbed in inadequate quantities it may be assumed that the spermatozoa can only be formed in small number. Our common experiences would seem to indicate this, for we know that a

[1] Cited after Pavy.

rich, plentiful diet frequently increases the sexual impulse, while, on the other hand, with poor and somewhat insufficient food—especially a strict vegetarian diet—it is usually diminished. An interesting illustration of this was witnessed by me at Salamanca several years ago, during a journey to the International Medical Congress in Lisbon, in the month of April. I saw in the streets quite a number of dogs running loose; one of them, a female, was following a thin, hungry-looking male dog, and although Darwin says that the female sex is of a more retiring nature than the male—a fact which I ascribe to the necessity of a more careful maintenance of the power of reproduction in the sexual organs—this doggie took the greatest pains to attract the male dog by resorting to all the usual endearments peculiar to these animals; all in vain, however, for he failed to carry out his natural duties. This starved animal, in which the ribs and in fact all the bones could be counted, could not be cajoled into such an expenditure of energy, which his miserable food was not capable of supplying. This was a manifestation of sexual apathy which is not often to be noticed in a male dog during the month of April.

It would appear that with a plentiful diet certain foods, such as eggs and fish—as has been confirmed by my own observations—have a stimulating effect upon sexual activity. Whitteween, who was busy at an educational establishment for abandoned young people in Ermeloo, also observed that fish, and likewise codliver oil, caused decided stimulation upon the sexual function. The question is, then, whether this peculiarity of fish does not lie in its chemical composition—in some mineral substance which would exert a powerful influence upon the sexual organs. Phosphorus would here first invite our attention, as it is contained in so considerable an amount in these foods.

Very interesting in this connection is a fact reported by Ragner Berg, who found, in the Lahmann Sanatorium

"Weisser Hirsch," that lecithin acts as an aphrodisiac; this would agree with what we have already stated.[1] If a diet rich in nucleins acts as an excitant upon the sexual function, this may be explained by the stimulating effect of such a diet upon the thyroid gland, for we know how intimate is the relation of this gland with the sexual organs. The favorable action of the phosphorus and lecithin-containing foods is also explainable through their influence in exciting nervous activity.

We might add, moreover, that truffles are supposed to act upon the sexual activity. As Brillat-Savarin says, "elles peuvent rendre les femmes plus aimables et les hommes plus amoureux" (they make women more amiable and men more amorous). Truffles are also very rich in phosphorus, as well as in iron. A similar action is ascribed to crabs and lobsters, for they also contain much phosphorus.

Iron, like phosphorus, has a decided influence upon the sexual activity. As we stated in our work on "Old Age Deferred," iron influences the formation of blood in a roundabout way through the ovaries, which, as is now admitted by all, greatly influence blood formation. Foods containing iron and phosphorus thus appear to have a very favorable effect upon sexual activity. The most marked influence is exerted by eggs, caviar, and truffles, which all contain much iron, though that contained in the last-named is in part very poorly assimilated.

The manner in which Brillat-Savarin treated a Parisian who found himself in a state of exhaustion after sexual excesses was most original. He ordered that an old cock be ground up in a mortar; 2 pounds of the very best beef, a handful of parsley, and 3 turnips, each in a separate pan, were boiled for three-quarters of an hour; then all these ingredients were mixed and boiled for another quarter of an hour, a

[1] R. Berg: Congrès International sur l'Alimentation, Brussels, 1910.

little water being added from time to time. Of this strong bouillon he ordered that one cupful be taken by the patient every three hours during the first day, and afterward one cupful every morning for several days. This procedure is interesting for the reason that, in the employment of the sexual organs of the cock, the principles of organotherapy were resorted to long before our time.

Conditions existing in the animal world are also interesting in this connection. I may mention here that according to my observations in England horses were in heat and sexually inclined after having eaten the horse-beans which are so much used in that country. It is for this reason that the hunting horses are there fed chiefly upon oats and are not given any of the horse-beans, as they would then become unmanageable because of their sexual excitement. Since horse-beans are much richer in phosphorus than oats, it may be assumed that by a proper selection of foods containing certain nutrient salts the sexual activity may be greatly stimulated.

4. *The Dietetic Treatment of Impotence as well as of Sexual Apathy and Sterility.*

Although we can, as has already been stated, with considerable certainty stimulate and increase sexual activity by means of a diet rich in phosphorus and iron, this does not by any means imply that we can thereby turn an impotent individual into a very potent one, any more than we can make a sensible person out of a stupid individual by merely administering plenty of phosphorus. The matter is not quite so simple as all that. We are able, to be sure, to furnish the necessary material for the functioning of the brain and sexual organs in the shape of nutrient salts, but the proper assimilation and utilization of this material depends upon the activity of the thyroid and sexual glands, and possibly also upon the hypophysis.

The last-named organ also stands in intimate relation with the sexual glands, just as does the thyroid. If the thyroid is degenerated, the sexual organs will also undergo degenerative changes, and *vice versâ.* The functions of these organs go hand in hand, and we can therefore, by increasing the sexual activity, also improve the intellectual capacity, which is greatly influenced by the condition of the thyroid and the sexual glands. In our work on "Old Age Deferred" we gave details to illustrate how frequently gifted and brilliant men have been sexually inclined. When the thyroid gland or the sexual glands are degenerated, not much can be accomplished by food alone; we must also give the required organic preparation in addition, and with this, according to my experience, in cases of testicular insufficiency or when alterations not too pronounced have occurred, very good results may be obtained, even in individuals of advanced age. The case of a youth who was suffering from testicular insufficiency and presented the appearance of a eunuch has already been referred to. When we are treating persons in whom the thyroid and sexual glands are in such a condition that they may still be enabled to carry out their functions—in many old men the testicles are in a pretty fair condition—we give the diet especially adapted, *i.e.,* fish, meat, eggs, caviar, certain vegetables, fruits, etc. This simply results in increased sexual desire, but it is a far step to a complete restoration of potency. The potency of a man does not really depend upon the degree, more or less pronounced, of his sexual impulse, which is certainly an allwise dispensation of the Creator, for if the libidinous men were also the most potent the human race would surely be threatened with extinction. The production of semen may be furthered by a rich and properly adapted diet, in case it is not present in sufficient quantity in advanced age or after some debilitating disease, or when the sexual impulse is impaired. The accomplishment of the act itself depends, however, upon the condition of the

organ involved, which may have undergone certain changes owing to diseases such as chronic gonorrhea, prostatitis, varicocele, etc. These factors have then to be removed. It also depends upon the circulation; there must be a sufficiently high blood-pressure so that sufficient blood will be carried to the member to enable erection to take place. When too much alcohol is taken at a time the blood-pressure is diminished and erection cannot occur. The state of the nervous system is of primary importance. When too much meat is taken daily, and when a person is very nervous, potency may be impaired from the fact that ejaculation occurs much too soon; there is then a condition of irritable impotency, with which are usually associated augmented sexual tendencies. In such cases the ingestion of meat must be restricted; it would be preferable to adhere for a time to the milk-egg-vegetable diet. Men much underfed are sometimes the most capable in regard to sexual requirements, inasmuch as the act is properly carried out by them, although they really have less sexual desire. Insufficient nourishment does, to be sure, act as a hindrance, because owing to insufficiency of blood no proper erection can take place. These facts prove that overnutrition may occasionally prove injurious; under such conditions a diet rich in phosphorus and sometimes also in iron is required; in fact, I have frequently obtained very good results with such a diet in treating impotent patients.

Such a diet—rich in phosphorus and iron—is also very necessary in sexual apathy in women. In combination with thyroid gland and ovarian extracts, and particularly with the aid of the customary mud baths at Carlsbad, Franzensbad, and Marienbad, very good results are obtained not only in sexual apathy, but also in sterility in women, when this is not due to anatomical alterations in the uterus or ovaries. The best results are obtained in cases where no apparent anatomical changes exist, *e.g.*, those in which there is simply an enfeeble-

ment of the ovaries—ovarian insufficiency—as so often occurs in chlorosis. Numerous experiments made upon animals have afforded clear evidence of the influence exerted by food upon their reproductive power, as well as their offspring.

5. *Addendum. Diet to be Used in Sexual Abstention.*

Some persons, by reason of their calling, *i.e.*, the Catholic monks and nuns who are bound by their vows, are obliged to lead a life of sexual abstemiousness. As has already been stated in our work on "Old Age Deferred," this may in some persons, although by no means invariably so, cause severe injury to the nervous system. Certain precautionary measures are therefore necessary, and much can be done in this connection by means of a rational diet. Foods containing much nuclein and phosphorus, such as meat, fish, and eggs, are to be avoided; also certain green vegetables, such as celery and asparagus, which, owing to their action upon the bladder, may have an excitant effect. Foods having laxative properties are advisable, since constipation may have an irritant stimulating effect by causing congestion of the pelvic organs. For such persons a vegetable diet would be indicated, but, since in subjects who do not spend much time in the open air—and this is particularly the case with many of the inmates of nunneries—a strictly vegetable diet may favor the development of tuberculosis, a milk and vegetable diet, with the addition of a limited quantity of eggs, would be preferable. It is hardly to be supposed that such a moderate addition of eggs could have an excitant effect, especially in the case of persons who have been trained to such a vocation. The greatest moderation in eating and drinking is a prime requisite in combating sexual desire, and, as Father Cats remarked: "Die weynigh eet en minder drinkt, die is het, die de lusten dwingt."

CHAPTER IX.

THE INCREASED MUSCULAR POWER RESULTING FROM A SUITABLE DIET.

WE have already referred to the astonishing feats of the Congo negroes, and would like to cite here the almost unbelievable achievement of 30 oarsmen who rowed the boat of the Commissary-general of the Congo army, Captain Meulemeester,[1] on the torrential Eau Blanche, a tributary of the Congo, for thirty-six hours, day and night, and this when rowing upstream. As food they had only a very young kid standing about thirty centimeters high; they ate this with the skin—after burning off the hair—including even the eyes. (As we have previously stated, these wild tribes are vegetarians by compulsion; when they do occasionally get an animal as food, they eat it with the skin and entrails.) During the thirty-six-hour journey no habitations were to be seen anywhere, so that the men were obliged to manage with this very limited quantity of food. Among some other strictly vegetarian peoples we also find examples of untiring capacity for work, as, for instance, in an Indian tribe the members of which carry tourists to the top of the Himalaya mountains, an ascent of 17,000 feet, in three and one-half hours. Their food is exclusively vegetarian. They live upon dates, rice, chapiti (a food made with "gram"), and a small amount of a kind of cooked butter (ghee). These people are so thin that they are truly "skin and bones," but are so indefatigable on the march that they allow themselves but a very short time for the absorption of their scanty rations of vegetable food. Notwithstanding

[1] Verbal communication.

the cold in the high mountain regions, these people go about entirely naked, save for a cloth tied about their loins.

We must not believe, however, that this untiring and unusual muscular activity is the result of peculiarities of race or climate, for very much the same thing may be observed among Caucasians. It is an undisputed fact that vegetarians are always ahead in any athletic feats where success depends upon the powers of endurance. In bodily exertions where great strength is required, as in the lifting of heavy weights, etc., this is, however, not the case; nor would I be able to understand how this could be possible with their sparing albuminous diet. For such work very powerful muscles are required; since these are built up of albumin, large quantities of the latter would have to be absorbed, and with a strictly vegetarian diet this is impossible. An animal which absorbs plenty of albumin, the lion, for instance, can jump over a hedge with a two-year-old ox in its mouth, but is unable to carry it very far. An ox would not be able to accomplish such a single feat of great strength, but it could drag a much heavier load for a considerable distance. In other words, a sudden and single effort of strength and energy is best accomplished when albuminous food is being taken, while untiring endurance results from vegetable food having a great carbohydrate content, which builds up muscles such as can be best observed in severe cases of diabetes. On the other hand, muscular fatigue, as has been shown by Mosso, can be counteracted by the ingestion of sugar. When a horse is very much fatigued after a long journey it is greatly refreshed and invigorated by sugar. As was shown by Van t'Hoff, the breast muscles of pigeons contain more glycogen than the liver. This substance thus occurs in the largest amounts precisely where it is chiefly required, *i.e.*, in the muscles used in flying. During the act of flying the quantity of glycogen in the breast muscles is diminished. Moreover, it becomes evident, from the results of a series of careful experi-

ments by Pettenkofer and Voit, that muscular effort does not of itself cause a loss in albumin, but that the contraction takes place at the expense of the fats and carbohydrates, as was also shown by Fick and Wislicenus. Consequently, when work is being performed fats and carbohydrates in quantities amply proportionate to the labor to be accomplished must be taken in combination with a sufficient quantity of albumin, as the work is principally performed at the expense of these substances; otherwise, the albumin content in the body will be impaired and emaciation occur. When plenty of fat and carbohydrate is present, the albumin is saved and the work accomplished in part by means of the other substances. In the food of the negro tribes above mentioned the carbohydrates are well represented in the form of bananas, sweet potatoes, and manioc. The wonderful feats accomplished by these men are to be thus accounted for. A negro carrier of the Zacongo tribe is able, for instance, to carry a load of about 37 kilos for eight hours, then to climb a mountain 300 meters high still carrying the load, and after a rest of one hour take the load up again and go on. In animals—horses—the same facts may be observed. A horse fed upon plenty of oats will get very tired after having run very quickly for several kilometers, while the Hungarian horses, fed upon much hay and very little oats, and which often do not stand much higher than a large dog, can proceed unceasingly for many hours. An ox gets food similarly poor in albumin, viz., hay, etc., and draws a heavy load for great distances. Just as animals require various foods according to the work they are expected to do,—the heavily worked horses in the mines in the vicinity of Sheffield are fed upon horse-beans, oats, and corn in considerable quantities,—so also with man the amount and nature of the work to be accomplished should be considered in determining his diet.

Addendum. Hints Concerning the Diet during Fatiguing Journeys, in Mountain Climbing, Rowing, etc.

From the above statements it will be observed that we must provide ourselves with considerable quantities of starch- and sugar- containing foods when preparing for a long and fatiguing excursion. A sufficient quantity of albumin must, above all, not be lacking, for the muscles which are to be in action must be supplied with more blood, just as is the case with every organ which is at work. For this purpose, and for the development of the muscular tissue, which is accomplished through this increased blood-supply, periodically induced, albumin is necessary. The ingestion of too much meat, *i.e.,* albumin, before starting on a climbing expedition is likely to prove very injurious, as one will very quickly become overheated and perspire freely, and the feeling of heaviness and drowsiness occasioned by this food will also be a hindrance. For breakfast some milk, oatmeal gruel, 1 or 2 eggs, butter, fruit, and honey would be most desirable. At noon, no meat, but 1 or 2 eggs, cheese, rice, tapioca, sago, fresh or dried fruits, chocolate, and milk are indicated, and the same for the evening meal. In case there should be no opportunity for going to a restaurant during the trip, it is best to take along bread, cheese, dates, dried bananas, figs, currants, pistachio nuts, and chocolate—all of them foods which take up very little space. We should also make it a rule never to walk for more than several hours without taking some nourishment. In this we should imitate the coachman, who feeds his horses whenever they have been on the road for several hours. If our machine, the body, is expected to do good work and not run down we must frequently provide it with food the combustion of which renders muscular exertion possible. We should consequently eat often and avoid the consumption of heavy meals, which are apt to

cause disinclination for the continuance of the climbing, rowing, bicycling, etc. While the ingestion of a certain amount of fluid is advisable, it is best to take fresh fruit—oranges, cherries—to quench the thirst. *This is the most rational mode of satisfying thirst.* Even after very fatiguing trips it is not well at once to eat meat, but rather rice, green vegetables, salad with lemon juice, and fresh fruits. Fruit juices are strongly to be recommended, particularly in the summer after one has perspired freely. During the trip those juices containing much sugar, such as grape-, cherry-, and agriot- juice, are preferable.

By personally testing various kinds of nourishment I have found that the greatest exertion can be best accomplished upon a milk-egg-vegetable diet. On the days when I made the longest walking tours, I took much rice, honey, dried fruit, etc. Thus, very often on Sunday afternoons I took walks in our mountainous region without the least fatigue, once in the hours between 2 o'clock and half-past 8 covering the distance of 26 kilometers—from Saifenhaüsel to Bärringen (near the boundary of Saxony), thence to Merkelsgrün, Lichtenstadt, and Carlsbad, and while on the way spent about an hour in Bärringen in walking around among the booths at a church festival; only twice during the entire outing did I sit down for about twenty minutes. I was not very much exhausted on my return home. With a meat diet I could not so easily have taken such an extended walk, which is by no means an unusual experience for vegetarians.

CHAPTER X.

Conclusion.

THE RELATIONSHIP OF FOOD TO OLD AGE AND LONGEVITY.

Already over one hundred years ago, Villenet[1] made the statement, before the Academy of Sciences in Paris, that, while among well-nourished rich people there occurred 1 death in 50, among the very poor classes the deaths were 1 in 4. Although the sanitary conditions are now greatly improved, it is undoubtedly the case that among the poor—and particularly as regards tuberculosis—the number of deaths is much greater, and it is probably not to be disputed that this mortality is due to insufficient nutrition. As we have already stated, this affects the formation of the blood and the resistance against infection, to which badly and inadequately nourished persons fall prey more readily and which frequently leads them to their graves. In this, as in so many other respects, there is no difference between mankind and animals. On the other hand, we observe that persons who take good food but do not overeat may live to an advanced age. Brillat-Savarin cites the case of Monsignor Belloy, Archbishop of Paris, who was greatly esteemed by Napoleon. He had always been a high liver and nevertheless lived for nearly a century. Napoleon himself, whose table was always spread and who ate whenever he felt so inclined, was not very particular in regard to his food; he ate poorly and, above all, most irregularly. He died at a comparatively early age, and who can say whether his tragic fall may not have been due to this irrational mode of living and faulty diet, which

[1] Cited after Brillat-Savarin.

was the cause of his gastric trouble and, later on, cancer of the stomach. How important a proper diet is for mankind! If Napoleon had done himself as was advised by one of his old generals who said: "Hâtons-nous de faire battre nos soldats pendant qu'ils ont encore le morceau de bœuf dans l'estomac" (let us make haste to have our soldiers fight while they still have a piece of beef in their stomachs), perhaps the history of the world would have taken a different turn. That our conclusions are correct is shown by the evidence submitted in the previous chapters.

Not only may life itself be shortened by a sparing or otherwise faulty and insufficient diet, but the condition of old age—senility—is brought on long before its time. Moderation in diet is a great virtue, but when carried to excess, like all other virtues, it becomes a vice. I certainly do not consider dieting indicated for a healthy, strong man, and I believe that I am correct in stating that persons who do follow such a diet often look old in comparison with those who are well nourished (though not overfed). Anyone who keeps cats or dogs knows that they look much better and more healthy, and are also much more lively, when plenty of food is given them. Sensible animals, as a rule, do not eat more than they require. I have been impressed by the fact that true vegetarians frequently present a pale, unhealthy, and prematurely aged appearance. This is not surprising in view of what we have already written concerning undernutrition, since the latter affects the formation of the blood and its distribution to the various organs. The nutritive salts are also furnished in insufficient quantities. This is especially the case with phosphorus, for when marked undernutrition is continued for some time phosphorus may even be eliminated. As Albu and Neuberg have so correctly stated, and as has also been shown through the labors of Roese and several other authors already quoted, mineral substances such as lime and phosphorus are very necessary for man; the

results of deficiency of phosphorus in the food have already been fully treated. It is certainly evident that serious injury must be occasioned when the necessary quantity of nutritive salts is not daily ingested with the food, and in this connection it should be remembered that in a one-sided, strictly vegetarian diet the assimilation of the salts which have been ingested is very poor. When insufficient lime and phosphorus is taken and assimilated, or when these substances are withdrawn from the food by overcooking or prolonged boiling, the condition of the teeth will suffer, just as the blood-supply and nutrition of the gums will be affected when the albumin content of the food is inadequate, thus giving rise to retraction and atrophy in them. This, of course, occurs principally in persons over the age of 50, but sometimes begins earlier. It rarely occurs in persons living upon a rational diet. When there is overnutrition, especially when the results of the latter—gout and the earlier symptoms of arteriosclerosis—appear, the nutrition of the gums often suffers. This may give rise to a loosening of the teeth, which may even fall out. Atrophy of the jaws may then follow, and the bony structure of the face sink in; this shortening may cause the jaws to be displaced inward, thus forming a pointed chin. The face then presents a very aged appearance. Similar changes take place in the case of the hair, which likewise suffers from the insufficient blood-supply; this is probably the principal cause of loss of hair when old age is approaching. Our various organs and tissues can only be nourished by the blood, and if the supply is inadequate they are bound to deteriorate.

The quantity and composition of the blood can be influenced by food and drink. The latter also affect other important organs, viz., the ductless glands, which in turn exert an influence on the formation of the blood and the blood-pressure. When the food is limited in quantity, or especially when it is not suitable and adequate in its constituents, these organs are

poorly supplied with blood and their activity is impaired; when, on the other hand, the food contains too large an amount of certain stimulating substances, such as the extractives of meat, long-continued overactivity, giving rise to exhaustion, inactivity, and degeneration of these very important organs, upon which depend the entire aggregate metabolic and nutritive processes of all organs and tissues, is the result. In this manner, as I have set forth in my work on "Old Age Deferred," age comes on and the span of life is shortened. This is brought about by undernutrition on the one hand and overnutrition on the other. *Undernutrition prevents young people from attaining a ripe old age,* and *overnutrition carries those of advanced age prematurely to their grave.* Consequently the requirements are: (1) more nourishing food for the young, growing organism, and (2) moderation in the succeeding periods of life. In childhood and in old age the diet is very similar. The aged person can manage well with few calories; if, however, he absorbs too many, especially in such substances as will, like meat, impose more work upon his already somewhat impaired ductless glands, the diminished activity of these protective organs will cause the retention of injurious substances, and, hence, autointoxication. The milk-egg-vegetable diet is consequently not only that best adapted for an old person, but also for one of middle age, since by it the ductless glands are well protected and kept in good condition until an advanced age, thus deferring old age for a considerable time. Indeed, we consider this diet as the most rational one for the attainment of the longest possible period of life in man, as well as for the preservation of the freshness of youth for the longest possible time. In the work already named I have cited several instances in which men lived to be over 100 years old on such a diet. These long-lived persons were, with very few exceptions, very temperate in their eating and drinking. Sir George Humphrey, basing himself upon the inquiry instituted by the

British Medical Association with regard to centenarians, similarly stated that they were very moderate in regard to eating; the majority took very little meat. Of 38 persons, there was only 1 who ate much meat. Very few indulged in alcohol. Anyone who is the offspring of healthy parents has it in his power to live to the age of 100, if he is temperate in eating and especially in drinking. He will have the best prospects for this result if he is careful that all food which he eats is perfectly fresh, and contains the greatest possible amount of unaltered curative substances which have been allotted to it by provident Mother Nature for our welfare. The food must also *taste good.* Old Father Cats was more or less right when he said in his old Dutch dialect:—

"Zy bitter of zoet,
Wat smackt, dat voet."
("Be it bitter or sweet,
What tastes good is meet.")

GLOSSARY.

Acromegaly. An abnormal development of the extremities.

Agglomerate. Massed together. Aggregated.

Albumin. A proteid, animal or vegetable, which is soluble in water and coagulable by heat.

Alexin. Any defensive proteid.

Alkaline. Having the properties of an alkali.

Amin. A compound derived from ammonia by the substitution of an alcohol radicle for hydrogen.

Amylopsin. A ferment of pancreatic juice.

Anemia. Deficiency of the blood in quantity or quality, either general or local.

Arteriosclerosis. The hardening of the arterial walls.

Assimilation. The process of transforming and absorbing food in the organism.

Basedow's Disease, Graves's Disease. A disease marked by protrusion of the eyes, enlarged thyroid gland, anemia, and overaction of the heart.

Beriberi. An East-Indian microbic disease characterized by weakness, anemia, dropsy, dyspnea, and paraplegia.

Buccal. Pertaining to the hollow part of the cheek.

Caloric. Pertaining to heat or its principle.

Calorie. The amount of heat necessary to raise 1 kilogram of water 1° C.

Carbohydrates. Compounds of water with hydrogen and oxygen, the latter being in the proportion to form water.

Casein. A derived albumin.

Cellulose. The predominating element of plant-tissue.

Chlorophyll. The green coloring matter of leaves.

Cirrhosis. Thickening of the connective tissue of an organ.

Collemia. A glutinous or colloid state of the blood.

Creatin. A neutral organic substance that occurs in the animal organism, especially in the juice of muscles.

Cretin. An idiot afflicted with goiter and a deficient development of the organism.

Cryoscopy. Accurate determination of the freezing point of liquids and solutions, especially of the body, as blood, urine, etc., for clinical study.

Dementia Præcox. Any form of dementia beginning at puberty and marked by negativism, stereotypy, mannerisms, and verbigeration.

Dextrin. A soluble, gummy substance obtained from starch.

Dextrose. A sugar of the glucose group.

Diabetes. The sugar disease.

Diabetes Mellitus. A disorder of metabolism characterized by chronic hyperglycemia and glycosuria on a diet not containing excessive amounts of sugar, and associated with polyuria, polydipsia, polyphagia, emaciation, often with dryness of the mouth and skin, and sometimes with boils, carbuncles, spontaneous gangrene, loss of sexual power, or nervous affections.

Diuresis. Abnormal increase in the secretion of urine.

Ductless Glands. Glands without an excretory duct.

Dulcin. A sweet crystalline substance used as a substitute for sugar.

Emphysema. A distention of the tissues with air or other gases.

Endogenous. Originating within the body.

Epithelium, -lia. Epithelial cells: cells which form the surface of the skin, mucous membranes, and line all canals having communication with the external air.

Glucose. Grape-sugar, starch-sugar.

Gluten. A substance resembling albumin.

Glycogen. Animal starch found in blood and liver.

Graminivorous. Feeding on grass and like food.

Hemialbumose. An albumose that is converted by further digestive activity into hemipeptone.

Hemoglobin. The coloring matter of the red blood-corpuscles.

Herbivorous. Said of that which eats vegetation.

Hydremia. A watery condition of the blood.

Hydrochloric. Consisting of hydrogen and chlorine.

Hyperacidity. An excess of acidity.

Hyphomycetes. Mold fungi.

Hypophysis. The pituitary body, called, more fully, hypophysis cerebri.

Inosite. A saccharine substance in the human body.

Inulin. A vegetable principle.

Kefir. A variety of fermented milk.

Kinase. A substance that converts a zymogen into an enzyme.

Larvæ. Immature form.

Lecithin. A phosphorized substance occurring widely in the body and in plant-tissues.

Leucocyte. The white corpuscle.

Maltose. A sugar derived from the action of diastase on barley.

Metabolism. A change in the intimate condition of cells, constructive or destructive.

Mucilaginous. Like mucilage. Ropy.

Nidus. A cluster. A focus of infection.

Nuclein. A nitrogenous constituent of cell-nuclei.

Nucleoalbumin. A nuclein from cell-protoplasm.

Nucleoproteids. Any of a class of compound proteids found in nearly all cell-nuclei, in protoplasm, etc., yielding, with alkalies, proteid, and nuclei acid as cleavage products and by pepsin digestion, true nucleins.

Opsonin. That quality of a serum which makes a microbe more susceptible to phagocytosis.

Osteomalacia. A morbid softening of bone.

Oxaluria. Presence of calcium in the urine in undue proportions.

Pancreatin. A ferment from the juice of the pancreas.

Pellagra. An erythematous skin affection with severe constitutional and nervous symptoms endemic in northern Italy, and attributed to use of spoiled maize.

Peptone. A proteid body produced by the action of digestion.

Peripheral. Pertaining to the periphery.

Peristalsis. The vermicular motion of the bowels.

Phagocytosis. The destruction of microbes by the action of phagocytes.

Phosphaturia. The presence in the urine of phosphates.

Polyneuritis. Affecting several nerves.

Prostatitis. Inflammation of the prostate gland.

Proteids. A general term for the albumin and albuminoid constituents of the organism.

Protein. The sulphur-free residue of a proteid after the action of caustic potash.

Ptyalin. A starch-converting ferment of saliva.

Purin. Unclean or poisonous substance foreign to our alimentary organism.

Pylorus. The opening of the stomach into the duodenum.

Pyorrhea, Alveolar. Progressive necrosis of the dental alveoli, or teeth sockets. The death of a circumscribed piece of tissue.

Rennet. An infusion of the inner coat of a calf's stomach.

Spermatozoa. Male sexual cells or sperm cells of an animal, whose function is the fertilization of the egg.

Staphylococci. Fission fungi. Bacteria.

Stenosis. A narrowing or constriction.

Streptococci. Form of genus of *Schizomycetes* of which the cocci are arranged in strings. A form of bacteria.

Sulphate Ammonium. Combination of a salt of sulphuric acid and the hypothetic base of ammonia.

Therapy, Therapeutics. That branch of medical science concerned with the application of remedies and the treatment of disease.

Thyroid Gland. A reddish organ, one of the so-called ductless glands, giving rise to one or more internal secretions and situated in front and on either side of the trachea.

Toxalbumins. Poisonous soluble albuminoids producing specific diseases.

Trichina. A genus of nematode (thread-like) worms, of which one species, the spiralis, is parasitic in the hog and at times in man.

Trichinosis. A disease produced by the ingestion of pork containing the *Trichina spiralis.*

Trypsin. A ferment of pancreatic juice which has the power of converting proteids into peptones, best in alkaline solution, but also active in neutral solution.

LIST OF DISEASES.

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